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A Review of North American Species of *Microdontomerus* Crawford (Torymidae: Hymenoptera)

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Abstract.—Four species of *Microdontomerus* Crawford have been recognized in the New World: *anthidii* (Ashmead), *anthonomi* (Crawford), *bicoloripes* (Crawford), and *fumipennis* Crawford. In this paper the genus is revised and the following new species are described: ***apianus, braconivorus, buprestae, ciscada, darwini, eboreus, enigma, gordhi, hemileucae, mysticus, parkeri, rictus, secus, westcotti,*** and ***zoyphius,*** making a total of 19 described New World species. Keys and illustrations are given to distinguish all species, and host and distribution data are summarized. The new species include parasitoids of range caterpillar eggs (possibly as hyperparasitoids); geometrid larvae; tachinid and braconid parasitoids of Lepidoptera; several burprestid crown borers; a cerambycid stem borer; root and stem weevils; and several solitary bees.

The genus *Microdontomerus* Crawford is known from nine species of which four are North American: *anthidii* (Ashmead), *anthonomi* (Crawford), *bicoloripes* (Crawford), *fumipennis* Crawford; four are Palearctic: *albipes* (Giraud), *annulata* (Spinola), *gallicolus* Zerova and Seryogina, *ovivorus* (Steffan); and one is Afrotropical: *senegalensis* (Risbec) (Grissell 1995, Zerova and Seryogina 1999, Noyes 2001). No species are yet known from the Australian or Oriental Regions, or from Central or South America. Because no keys or reviews have been published for the relatively few North American species of *Microdontomerus,* the purpose of this paper is to document the occurrence of 15 previously undescribed species for the area and to provide a key and illustrations to identify them. This paper essentially covers all known information for New World species of *Microdontomerus,* most of which appear to be primarily western North American.

Most species of *Microdontomerus* appear to have a narrow host range, but the overall array of insects attacked by members of the genus is conversely broad. For example, several species are parasitoids of various life stages of Lepidoptera; several attack larvae of bees and one attacks cynipids; one is an egg parasitoid of buprestids; and one has been reared from mantid egg cases. Several species have broad host ranges, and are hyperparasitoids through either a lepidopterous or coleopterous host. In the former case, the wasp also attacks ichneumonid parasitoids (Peigler 1985), and in the latter the wasp attacks tephritids that live in the same microhabitat (Turner et al. 1990). Hosts for new species described in this paper include range caterpillar eggs (possibly as a hyperparasitoid); geometrid larvae; tachinid and braconid parasitoids of Lepidoptera; several burprestid crown borers; a cerambycid stem borer; root and stem weevils; and several solitary bees. Apart from host data, little biological information is available for New World species, and what little is available is summarized under individual species below.

Species of *Microdontomerus* are rarely captured by sweeping or in traps (e.g., Malaise or yellow pan) and seem to be taken most often as rearings in association with a particular host insect under study. Some species appear to be quite common (e.g., those associated with bee rearings), but still are poorly represented in collections. Due to their relatively small size (2–4 mm), cryptic hosts, and difficulty of collection, it is likely that many additional species of *Microdontomerus* remain to be discovered.

METHODS

Recognition of species of *Microdontomerus* relies in large part on variations in several aspects of wing setation. The two extremes in setation are shown in Figs. 5 and 6. The latter figure shows an "open" basal cell, which occurs when the setation of the cubital vein does not extend to the base of the wing (i.e., it stops at the junction with the basal vein). When the setation does extend to the base it is considered a "closed" basal cell (Fig. 5). In some species there is a distinct admarginal area (posterior to the marginal vein, Fig. 6) that is nearly bare, having only a few random setae. In a few species this area (Fig. 5) is not distinct because it is covered with setae. Another important wing setation character involves whether the costal cell has setae on the apical margin of the dorsal surface (Figs. 5, 8) or not (Figs. 6, 7). So far no distinct differences have been found on the ventral surface. Various combinations of setal states exist involving the basal vein and setae within the basal cell, but these are rarely present/absent states and tend to vary between species by degree. In using setation characters it is necessary to have well preserved, clean specimens or at least a series of specimens because the setae are sometimes difficult to see or break off. They are best examined using light reflected from beneath the wing.

In the descriptions and key I use the torulus position in a general sense of whether it is below or above the ventral margin of the eyes. Because it is sometimes relatively difficult to judge the position by simple examination, I used an eyepiece cross-hair/measuring graticule as an aid. With the head in its most horizontal plane, one of the cross-hair lines was aligned horizontally across the venter of the eyes and the position of the torulus was determined relative to this line. For example, Figs. 26 and 27 show the dorsal margin of the toruli beneath the ventral eye margin, whereas Figs. 28 and 31–34 show the ventral margin of the toruli to varying degrees at (Figs. 34) or distinctly above (Fig. 31) the ventral eye margin. In some cases the toruli are intermediate just about at a midpoint above and below the margin (Figs. 29, 30).

Of some diagnostic use is whether or not the scape reaches the venter of the midocellus. In some cases the scape is appressed against the face, and it is obvious how much distance, if any, remains between its apex and ocellus. When this is not the case, it is possible to measure the length of the scape and compare it to the measured distance from the dorsum of a torulus to the venter of the median ocellus. Generally the distance can be expressed as a factor of whether or not the scape reaches or nearly reaches the ocellus (e.g., Figs. 29, 34) or is separated from it by a distinct gap (e.g., Figs. 26–28).

Host-plant names were checked using GRIN (2004) and host insects using Poole and Gentili (1996, and website: http://www.nearctica.com/nomina/wasps/hymenop.htm). Bee nomenclature follows Michener (2000). Because of the complexity of handling insect and plant host names, authors, and order and family information, I treat these data as follows: Author names for all insect hosts are given in the Host-Parasitoid list at the end of the paper, not the first time they appear in the text. Author names for plants are given in the species "Host" section rather than the "Material examined" section where they

are first mentioned as part of a collection label. Since plants are not the primary host, they are not listed in the Host-Parasitoid list. Family names for both insects and plants are included in the "Host" section as an aid to the reader in determining general host preferences.

Abbreviatons used in the descriptions are: MV = marginal vein; PV = postmarginal vein; SMV = subcostal vein; SV = stigmal vein. Acronyms used for museums from which material was borrowed and curators who loaned the material (in parentheses) are as follows: CNC = Canadian National Collection, Ottawa, Ontario (G. A. P. Gibson); UCD = University of California, R. M. Bohart Museum, Davis, California (S. Heydon); UCR = University of California, Riverside, California (S. Frommer, S. V. Triapitsyn); USU = Utah State University (F. D. Parker, W. Hanson); USNM = National Museum of Natural History, Washington, DC.

Microdontomerus Crawford

Microdontomerus Crawford 1907b:179. Type-species: *Torymus anthonomi* Crawford, by original designation.

Antistrophoplex Crawford 1914:125. Type-species: *Antistrophoplex bicoloripes* Crawford, by original designation. [Synonymized by Grissell in Boucek 1982:189.]

Paraholaspis Masi 1921a:168–169. Type-species: *Paraholaspis cothurnata* Masi, by monotypy [= *annulata* Spinola]. [Synonymized with *Antistrophoplex* by Boucek 1976:347.]

Plastotorymus Masi 1921b:235–236. [Unnecessary n. name for *Paraholaspis* Masi 1921a, believed preoccupied by *Parholaspis* Berlese 1918:174 (Arachnida): Steffan 1962:30.]

Plastotrymus: Grissell 1995:202. Misspelling.

In my 1995 review of the family Torymidae (Grissell 1995) I found it difficult to distinguish species of *Microdontomerus* from *Idiomacromerus* Crawford. At the time I could provisionally recognize the two genera based on a single character, namely the presence of a single anellus in the former instead of two (or more) found in the latter. This separation appeared to be operational as much as phylogenetic (especially in the definition of what an anellus is as discussed in Grissell 1995). While it is true that all species of *Idiomacromerus* have two anelli, it now appears that some specimens of *Microdontomerus* have two as well, even in the same species. For example, in a series of reared specimens of *M. bicoloripes*, which range in size from 2 to 3 mm, larger specimens have the first funicle segment quadrate to longer than wide and with placoid sensilla, but smaller specimens have the first funicle much wider than long and without sensilla. Intermediates occur in which the segment is reduced but has one sensillum. This reduction is uncommon but does occur.

It is possible that a more reliable character to separate these genera is that *Microdontomerus* does not have an occipital carina, whereas *Idiomacromerus* has either a well-defined carina or at least a fold, line, or change in sculpturing that can be seen at some angle of view. In some cases the latter condition is somewhat subjective, as is the recognition of anelli, so that recognition of genera is, in rare cases, nebulous. I suspect that as more species are recognized the overlap will completely obscure generic limits, but for now it seems better to recognize the genera until a thorough study of world species can be made.

KEY TO FEMALES OF NORTH AMERICAN *MICRODONTOMERUS*

1. Clava (Fig. 53) appearing 4-segmented, with ventral area of micropilosity (except proximal half of first clavomere); toruli (Fig. 29) midway above and below venter of eye; ovipositor 0.7× length of metatibia; admarginal area of forewing shaded . . . . . *secus* **Grissell, n. sp.**

– Clava (Figs. 46, 55) appearing 3-segmented, without ventral area of micropilosity; other characters variable but not found in combination 2

2. Ovipositor sheaths much longer than entire body, about 6× metatibia (greatly curved over body and difficult to measure); clypeus broadly rounded, projecting beyond lateral corners of mouth (Fig. 34); antenna with most flagellomeres longer than wide and clava apically narrowly pointed (Fig. 47) ..... ***darwini*** **Grissell, n. sp.**
– Ovipositor sheaths at most as long as body, less than 2.5× metatibia (essentially pointing straight back and easily measured); clypeus at most narrowly rounded (Figs. 27, 31) and variable with respect to lateral corners of mouth; flagellomeres mostly wider than long and clava rounded (Figs. 48, 54) or at most broadly acute (Figs. 46, 50) 3

3. Scutellum dorsally flattened (Fig. 19, 21), either completely polished and shiny or less sculptured (aciculate) in contrast to anterior of scutum, never reticulately sculptured; venter of torulus half-way (Fig. 30) to nearly completely below ventral eye margin (Fig. 27); pedicel about 2× as long as broad apically (Fig. 46, 48); ocellocular distance greater than longest lateral ocellus diameter (Fig. 40) 4
– Scutellum dorsally arched (Figs. 16–18, 20), similar sculpture to scutum and neither polished nor shiny (if somewhat flattened sculpture reticulate); venter of torulus above ventral eye margin (Figs. 28, 31–33); pedicel 1.5× or less as long as broad (Fig. 50, 54, 55); ocellocular distance variable, but usually (i.e., common species) equal to or less than longest lateral ocellus diameter (Fig. 39) 9

4. Propodeum with denticle above posterolateral corner (Fig. 25); MT2-6 medially deeply incised (Fig. 41) ..... ***buprestae*** **Grissell, n. sp.**
– Propodeum without denticle above posterolateral corner (Fig. 24); MT2-6 medially at most slightly emarginate (Fig. 42) 5

5. Face broad (Fig. 26): toruli about 2 diameters apart, eye height about 1.5× malar distance, distance between eyes about 1.5× eye height; clypeus recessed relative to corners of oral fossa (Fig. 26); forewing admarginal area with reduced setation not reaching marginal vein (as in Fig. 8) ..... ***rictus*** **Grissell, n. sp.**
– Face narrow (Fig. 30): toruli about 1 diameter apart, eye height 1.7–2.0× malar distance, distance between eyes less than 1.2× eye height; clypeus even with or projecting beyond lateral corners of oral fossa (Fig. 30); forewing admarginal area evenly setose nearly to marginal vein (Fig. 12) 6

6. Costal cell above with setal row along anterior margin (Fig. 12); propodeum with distinct, raised median carina, subtended laterally by nearly polished depressions bordered by irregular carinae (Fig. 24); longest lateral ocellus diameter less than 1.5× ocellocular distance 7
– Costal cell above without setal row along anterior margin (as in Fig. 6); propodeum with weak (as in Fig. 22) to distinct median carina not subtended by depressions or outlined by carinae; longest lateral ocellus diameter 1.5 to 2× ocellocular distance 8

7. Malar distance about 1.5× intermalar distance (Fig. 30); anellus transverse (Fig. 52) scutellum shiny but not polished, nearly evenly covered with aciculate sculpture ..... ***ciscida*** **Grissell, n. sp.**
– Malar distance about 2.0× intermalar distance (Fig. 35); anellus distinctly elongate (Fig. 48) scutellum shiny, essentially polished ..... ***mysticus*** **Grissell, n. sp.**

8. Propodeum medially faintly sculptured (aciculate), about as shiny as scutellum; with weak median carina barely raised above surface (as in Fig. 22); ocellocular distance about 2× longest lateral ocellus diameter; ovipositor nearly 1.5× metatibial length ..... ***westcotti*** **Grissell, n. sp.**
– Propodeum medially more heavily sculptured (reticulate) than scutellum; with strong median carina raised above surface (as in Fig. 24); ocellocular distance about 1.5×

longest lateral ocellus diameter; ovipositor about 1× metatibial length ..... ***zoyphins* Grissell, n. sp.**

9. Forewing setation (Figs. 6, 7) reduced: basal cell open behind, i.e., cubital vein basally at most with few isolated setae; basal vein at most with isolated setae; basal cell without distinct setal row paralleling submarginal vein 10
– Forewing setation (Figs. 5, 11) not reduced (except in admarginal area of some species): basal cell closed behind, i.e., cubital vein essentially completely setose to base of wing; basal vein with distinct setal row and basal cell with setal row paralleling nearly entire submarginal vein 11

10. Postmarginal vein (Fig. 7) about 0.75× as long as marginal vein; forewing with admarginal area (Fig. 7) not well defined posteriorly by setal line, with admarginal setae nearly as uniform as central area of wing ..... ***enigma* Grissell, n. sp.**
– Postmarginal vein (Fig. 6) about 0.5× as long as marginal vein; forewing with admarginal area (Fig. 6) well-defined posteriorly by setal line, with few sparse setae not as uniform as central area of wing ..... ***parkeri* Grissell, n. sp.**

11. Costal cell without anterior setal row on upper margin (Figs. 9, 10, 11, 14) 12
– Costal cell with anterior setal row on upper margin (Figs. 8, 13, 15) 15

12. Admarginal area of forewing with dense setae reaching almost to marginal vein (Fig. 11, 14); axillular carina flattened and at least somewhat widened (Figs. 17, 18); intermalar distance 1.5× or less than malar distance 13
– Admarginal area of forewing relatively sparsely setose with setae not reaching marginal vein (Figs. 9, 10); axillular carina narrow (Fig. 16); intermalar distance greater than 1.5× malar distance 14

13. Posterolateral corners of propodeum angulate (Fig. 22); axillular carina obviously widened and triangularly expanded dorsally (Fig. 18); flagellum and femora black, scape and tibiae orange ..... ***gordhi* Grissell, n. sp.**
– Posterolateral corners of propodeum rounded; axillular carina somewhat widened, but not expanded dorsally (Fig. 17); flagellum, scape, and legs concolorus white ..... ***eboreus* Grissell, n. sp.**

14. Ocellocular distance (Fig. 38) larger (1.5×) than lateral ocellus diameter; pedicel about 1.5× as long as wide at apex; ovipositor about 2.5× as long as metatibia ..... ***bicoloripes* (Crawford)**
– Ocellocular distance subequal to lateral ocellus diameter; pedicel (Fig. 50) about as long as wide at apex; ovipositor about 1.5× as long as metatibia .. ***hemileucae* Grissell, n. sp.**

15. Eye height nearly 3× malar distance (Fig. 31); distance between eyes less than eye height (Fig. 31) 16
– Eye height 2.5× or less malar distance (as in Fig. 36); distance between eyes equal to or greater than eye height (as in Fig. 36) 17

16. Admarginal area of forewing more sparsely setose than central disk of wing, with setae unevenly spaced and bare areas near marginal vein (Fig. 8); ocellocular distance about 0.5–0.8× lateral ocellus diameter ..... ***anthidii* (Ashmead)**
– Admarginal area of forewing with dense, evenly spaced setae (similar to central disk of wing) reaching almost to marginal vein (Fig. 5); ocellocular distance about equal to lateral ocellus diameter ..... ***anthonomi* (Crawford)**

17. Admarginal area of forewing with dense setae reaching almost to marginal vein (as in Fig. 5); admarginal and median area of wing with brown infumation; distance between eyes greater than eye height; ovipositor 1.5× metatibia ..... ***fumipennis* Crawford**
– Admarginal area of forewing relatively sparsely setose with setae not reaching marginal

vein (Figs. 13, 15); wing hyaline; distance between eyes subequal to eye height; ovipositor less than 1× or more than 2× metatibia 18

18. Ovipositor obviously much shorter than metasoma, 0.5× metatibia; scape black; wing veins white ..... ***braconivorus*** **Grissell, n. sp.**
– Ovipositor obviously much longer than metasoma, as long as body, 2.5× metatibia; scape mostly yellow; wing veins brown ..... ***apianus*** **Grissell, n. sp.**

Microdontomerus anthidii (Ashmead)
Figs. 8, 16, 31, 54

Torymus anthidii Ashmead in Davidson 1896:26. Lectotype ♀, designated by Grissell (1995: 203), Los Angeles County, California, USA (USNM, examined); 11♀, 1♂ (an additional 4 specimens too badly damaged to determine sex) paralectotypes same data as lectotype.
Microdontomerus anthidii (Ashmead): Huber 1927: 108 (generic transfer).

Lectotype female.—Body length excluding ovipositor 2.1 mm, ovipositor 0.7 mm. Body black with metallic green reflections except as follows: straw-yellow are: scape, flagellum (shaded to black), all tibiae; whitish are: all tarsi, wing veins. **Head:** Distance between eyes shorter than eye height; clypeus (Fig. 31) projecting slightly beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 1:5:2; toruli about own diameter above lower margin of eyes; toruli about 1 diameter apart; intermalar distance about 2.5× malar distance; eye height about 3.5× malar distance; antenna (Fig. 54♀) with pedicel laterally about 1.5× as long as broad apically, anellus distinctly transverse, funicle segments all wider than long, flagellum slightly wider distally than proximally (somewhat spindle-shaped), scape not reaching median ocellus and separated from it by about one ocellus diameter. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina reduced and narrow (Fig. 16); dorsellum more or less flat, with obscure wrinkled sculpture; propodeum essentially without pits along apical margin (inconspicuous perpendicular carinae are present), medially somewhat flattened and shiny, with delicate carina extending from dorsal margin about half way to nucha which is a narrow, arched polished carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle greater than its own longest inner diameter from posterior margin of metanotum, median length of propodeum about 4× longest inner spiracle diameter; forewing (Fig. 8) ratio PV: MV:SV:SMV as 15:23:7:45, postmarginal vein about 0.7× marginal vein, costal cell below with 1 to 2 complete anterior setal rows, apical ½ setose below, upper surface with complete anterior setal row; basal setal line incomplete with gap towards anterior (below submarginal vein); cubital setal line complete (i.e., basal cell closed), with partial bare areas paralleling either side, dorsal area ending at about midpoint of marginal vein, ventral area ending at about apex of marginal vein; basal cell with 1 or 2 setae basally [no row in lectotype but present in paralectotypes]; admarginal area not defined by posterior setal line, with few wide spaced setae on bare area paralleling marginal vein; parastigmal area and basal area bare; stigmal area setose to apex of postmarginal vein. **Metasoma**: Terga entire at apico-median margin; ovipositor sheaths subequal in length to metasoma, 1.2× as long as metatibia.

Male paralectotype.—Body length 1.3 mm. Color, sculpture, and other characters about as for female except: eye height nearly 4× malar distance; scape ventrally

flat and polished; antenna (Fig. 54♂) with F1–2 anellus-like (i.e., without apparent multiporous plate sensilla); basal cell with 3 or 4 setae basally posterior to submarginal vein.

Variation.—The following discussion of variation is based on the paralectotype series (comprised of 7 points with 16 specimens, scarcely any of which are entire) and then compared to a long series of specimens from Riverside, California. In the type series, female body lengths (without ovipositor) range from 1.6 to 2.0 mm (there is only one male as described above). The median propodeal carina varies from absent to about half the propodeal length. The upper, anterior row of setae in the costal cell may be interrupted and thus be incomplete (apparently because the setae have broken off). The basal setal line is complete in most specimens, and the basal cell has a setal line that reaches half way or more to the basal vein. In measurable females (n = 3), the ovipositor is 1.1 to 1.2× as long as the metatibia.

In the Riverside specimens, female body lengths (without ovipositor) range from 1.6 to 2.3 mm, and males from 1.5 to 2.0 mm. The propodeal carina varies from about half the propodeal length (as in the lectotype) to a single complete carina, to several somewhat irregular carinae. The basal cell has a setal line reaching from half way to all the way to the basal vein. The ovipositor ranges from 1.0 to 1.2× as long as the metatibia.

In all specimens the ocellocular distance is less than the lateral ocellus diameter, varying from 0.5 to 0.75× the greatest ocellus diameter. The median propodeal carina appears to vary based on size, with smaller specimens having none and larger ones having several irregular carinae.

A series of 23 female specimens from Glamis, California (USU), differ from typical *M. anthidii* in having consistently longer ovipositor sheaths from 1.5 to 2.2× the metatibial length. These specimens were reared from a vespid host (see Hosts, Discussion, below) and it is possible they represent a distinct species, but additional rearings of both morphotypes are needed to solve this problem.

Material examined.—I have seen the type material as detailed above and the following from California: 1♀, 1♂ Inyo Co.: 31 mi. ENE Big Pine, 25 May 1994, S. Heydon, off *Encelia* (UCD); 36♀, 5♂ Riverside Co.: Riverside, 3 April 1938, Timberlake, ex nest *Dianthidium* (UCR); 2♀ Riverside, March 1971, A. R. Hardy, ex resin bee nest (UCR); 1♀ White Water, 27 March 1955, W. R. Mason (CNC); San Bernardino Co.: 2♀ Apple Valley, 20 May 1055, W. R. Mason (CNC); 1♀ Daggett, 22 May 1955, W. R. Mason (CNC); 1♀ Helendale, 27 May 1955, W. R. Mason (CNC); 2♀ Hesperia, 12 June 1952, Timberlake, ex nest *Dianthidium* (UCR); 23♀, 9♂ Imperial Co.: Glamis, coll. January 1964, F. Parker, ex *Leptochilus* nests in old beetle borings in *Ephedra* stems (F. Parker per. comm.) (USU, USNM).

Distribution.—Known so far only from southern California.

Hosts.—The type series was reared from *Dianthidium pudicum consimile* (as *Anthidium consimile*), and some other specimens were reared from the same host genus. The series reared from stems containing pupal cells of *Leptochilus* are only tentatively placed as *M. anthidii* (see Variation, above, and Discussion, below).

Discussion.—In 1995 I designated a lectotype for this species (Grissell 1995) without giving a reason for doing so. As a number of specimens were described by Ashmead (in Davidson 1896), but none was selected as holotype, I selected a single female as lectotype to insure nomenclatural stability.

Microdontomerus anthidii, *M. enigma*, and *M. parkeri* are all reared from bees, and for some time I had confused their identities. Generally *M. anthidii* is smaller (2.3 mm or less) with a shorter ovipositor (less than 1.2× metatibia), whereas *M. parkeri* is larg-

er (up to 3.0 mm) with a longer ovipositor (more than 2× metatibia). *Microdontomerus enigma* is about the size of *M. anthidii*, but with the longer ovipositor of *M. parkeri*. *Microdontomerus anthidii* is fairly easily separated from the other two, however, based on discrete morphological differences in the forewing: *M. anthidii* has a complete setal row along the upper anterior margin of the costal cell (absent in the latter two species) and the basal cell is closed (open in the latter two species).

It appears that while all three species attack megachilid bees, *M. anthidii* is usually associated with species of the tribe Anthidini that create nests of resin and sand grains, whereas *M. parkeri* and *M. enigma* are associated with Osminiini and Megachilini that make stem nests. Interestingly, the questionable specimens of *M. anthidii* from Glamis, which appear to differ from typical *M. anthidii* only in ovipositor length, were reared from stems in which euminine vespid larvae coated their cocoons with sand grains incorporated into the cover of each cell by the adult female wasp (F. Parker, pers. comm.).

Microdontomerus anthonomi (Crawford)

Figs. 5, 20

Torymus anthonomi Crawford 1907a:133. Lectotype ♀, designated by Grissell (1995: 203), Waco, Texas, USA (USNM); 1♂ paralectotype same as lectotype, 2♀ paralectotypes, Hallettsville, Texas (USNM).

Microdontomerus anthonomi (Crawford): Crawford 1907b: 179 (type of new genus).

Holotype female.—Body length excluding ovipositor 3.0 mm, ovipositor 1.4 mm. Body black with metallic green reflections except as follows: orange are: scape, flagellum (shaded to black), apices of femora (metafemur most extensive at ¼), all tibiae; whitish are: all tarsi, wing veins. **Head:** Distance between eyes shorter than eye height; clypeus projecting slightly beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 1:3:1; torulus slightly less than own diameter above lower margin of eyes; toruli about own diameter apart; intermalar distance about 2× malar distance; eye height about 3× malar distance; antenna with pedicel laterally about 1.5× as long as broad apically, anellus distinctly transverse, funicle segments all wider than long, flagellum slightly wider distally than proximally, scape not reaching median ocellus and separated from it by about one ocellus diameter. **Mesosoma:** Scutellum convex (Fig. 20), not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina reduced and narrow (Fig. 20); dorsellum more or less flat, with obscure wrinkled sculpture but no distinct carinae; propodeum with row of pits along apical margin, pits largest medially growing smaller laterally, medially with complete irregular carina more pronounced in dorsal than ventral half, nucha a narrow, lunate polished carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle about 2× own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing (Fig. 5) ratio PV:MV:SV:SMV as 15:24:8:48, postmarginal vein about 0.6× marginal vein, costal cell below with 2 to 3 complete anterior setal rows, essentially covered except for lunate area medially, upper surface with setae along anterior margin in apical half (best seen on right wing); basal setal line complete; cubital setal line complete (i.e., basal cell closed), with bare areas paralleling either side, dorsal area ending at about midpoint of marginal vein, ventral area ending at about apex of marginal vein; basal cell with partial anterior setal row paralleling submarginal vein; admarginal area not defined by posterior setal line, evenly covered with setae but narrow bare area paralleling marginal vein, parastigmal area and basal area bare; stigmal area with narrow bare surface to

apex of postmarginal vein. **Metasoma:** MT2 slightly emarginate at apico-median margin, remaining terga entire; ovipositor sheaths subequal in length to metasoma, about 1.9× as long as metatibia.

Male paralectotype.—Body length 2.0 mm. Color, sculpture, and other characters about as for female except: malar distance shorter, intermalar distance nearly 3× malar and eye height nearly 4× malar distance; stigmal area with several setae (i.e., not appearing bare).

Variation.—Based on all examined specimens, females vary in length from 2.0 to nearly 4.0 mm (excluding ovipositor); males from 1.0 to 2.5 mm. Color is the most variable aspect, even within the same population. Especially variable is the amount of orange on the femora. At one extreme, only the apex of the metafemur is orange, and at the other all femora are orange. In some populations the scape and pedicel may be entirely orange, entirely black, or some combination of both with the orange color beginning at the base of the scape and expanding upwards. In some specimens of both sexes, the stigmal area may have several setae and not appear bare as is typical for this species. In one population (Napa County, California, UCD) there is a slight brownish infumation near the stigma in six out of seven specimens.

Material examined.—Type material is detailed in the synonymy above. In addition I have seen 166♀ and 34♂ from the following countries and states (CNC, UCD, UCR, USNM, USU): Canada (British Colombia); Mexico (Durango, Sonora, Oaxaca); USA: Arizona, Arkansas, California, Colorado, Georgia, Idaho, Kansas, Maryland, Montana, Nebraska, New Jersey, North Carolina, South Carolina, Texas, Utah, Washington. Additional published state records not confirmed: Louisiana, Missouri, Oregon, Virginia (Peck 1963, Grissell 1979).

Distribution.—This species is transcontinental in the continental United States and has been found in the north from British Columbia, Canada to Oaxaca, Mexico in the south.

Hosts.—In Crawford's paper (1907a) no rearing records were explicitly given listing *Anthonomus grandis* as a host, but the type material all bear labels reading "*Anthonomus grandis*" (Curculionidae) and the title of the paper was "New hymenopterous parasites of *Anthonomus grandis*, Boh." (see also discussion in Turner et al. 1990). Crawford (1907a) stated that one additional female was reared from *Brachytarsus* (now = *Trigonorhinus*) in heads of *Siderianthus rubiginosus* (Torr. & A. Gray) (now = *Haplopappus rubiginosus* Torr. & A. Gray according to W³TROPICOS 2004; I cannot confirm the host record based on extant specimens). Peck (1963) gave a list of papers relating to hosts of this species, but I have not been able to confirm all records by examination of voucher specimens. Hetz and Johnson (1988) added many new hosts, especially related to leguminous seedpods. Turner et al. (1990) summarized the known hosts and biology and added several new records.

The collective known insect host records include the following (all confirmed by this study): Anthribidae: *Trigonorhinus* sp.; Chrysomelidae (Bruchinae): *Acanthoscelides aureolus, A. compressicornis, A. desmanthi, A. derifieldi, A. horni, A. mixtus, A. pullus, Bruchus brachialis, B. pisorum, Sennius morosus, Stator limbatus, S. pruininus*; Curculionidae: *Anthonomus grandis*; Coleophoridae: *Coleophora malivorella, C. parthenica*; Tortricidae: *Ancylis comptana*; and Braconidae: *Bracon mellitor.*

Plant host associations (i.e., without known insect host) confirmed by this study are (specimens in CNC, USNM): all Fabaceae: ex seeds *Acacia constricta* Benth.; ex seed pod *Astragalus asymmetricus* E. Sheld., ex seeds *A. douglasii* (Torr. and A. Gray) Jeps., ex seed pod *A. lentiginosus* Douglas ex Hooker, ex seed pod *A. praelongus* E. Shield, ex seed pod *A. thurberi* A. Gray, ex seed pod *A. wootoni* E. Shield.; ex

seeds *Calliandra eriophylla* Benth.; ex seeds *Cassia covesii* A. Gray, ex seed pod *C. roemeriana* Scheele; ex seeds *Cercidium floridum* Benth. ex A. Gray; ex seeds *D. covillei* (Britton and Rose) Wiggins ex B. L. Turner, ex seed *Desmanthus illinoensis* (Michx.) MacMill. ex B. L. Bor. and Fernald, ex seed *D. velutinus* Scheele, ex seeds *D. virgatus* (L.) Willd.; ex seeds *Indigofera suffruticosa* Mill.; ex seeds *Mimosa biuncifera* Benth.; ex seed *M. microphylla* Dry.

In addition, *M. anthonomi* has been reared from insects introduced into the Nearctic as biological control agents of various weeds (Asteraceae except as noted), including the weevils *Rhinocyllus conicus* on thistle (*Carduus* spp.: Wilson and Andres 1986, Littlefield 1991), *Bangasternus orientalis* on yellow starthistle (*Centaurea solstitilais* (L.)), and *Microlarinus lareynii* on puncturevine (*Tribulus terrestris* L.: Zygophyllaceae), and also the tephritid *Urophora affinis* on yellow starthistle (Turner et al. 1990) and several other knapweeds (*Centaurea maculosa* Lamarck, *C. diffusa* Lamarck) (Goeden and Ricker (1970) [identified as *Microdontomerus* sp.], Lang and Richard 1999).

Biology.—Early work on the biology of this species was published by Pierce 1908a, 1908b, 1910) and Pierce et al. (1912, including figures of egg, pupa, and adult). These papers were summarized by Turner et al. (1990). The species is a solitary ectoparasitoid and also functions as a facultative hyperparasitoid. As a parasitoid of *Anthonomus grandis*, the wasp attacks weevil larvae in buds, seed capsules, and stems. Twenty-three percent of interactions with *Anthonomus* were as a secondary parasitoid through *Bracon mellitor*. Hansson et al. (2004) reported a species of *Microdontomerus* comprising 2.9% of the guild of parasitoids attacking *Acanthoscelides* in several species of *Phaseolus* in Mexico. This *Microdontomerus* is almost certainly *M. anthonomi* based on the host.

Although the majority of reported hosts appear to be beetles, especially those associated with seed pods or seed heads, *M. anthonomi* appears to be a host-species generalist, but a microenvironment specialist on hosts enclosed in flower or seed heads. It does not seem surprising that it has been reared from non-beetle hosts in seed heads (e.g., Lepidoptera) or that it attacks insects introduced from Europe for the biocontrol of weeds (e.g., Diptera, Coleoptera). In the latter instance, over a period of 20 years of sampling, parasitism has never risen over 2–3% (Lang and Richard 1999).

Discussion.—In 1995 I designated a lectotype for this species (Grissell 1995) without giving a reason for doing so. At that time the status of the type material was questionable. Crawford (1907a) listed the type locality as Waco, Texas, from which 1 female and 1 male were collected and both were marked "Type" in his handwriting. Two females from Hallettsville, Texas, were listed as "also" examined; these specimens were labeled "paratypes" in Crawford's hand. Crawford possibly meant the male and female "types" to be holotype and allotype, but this still left the question of which sex was the holotype. To insure stability of nomenclature I designated the female as lectotype for the species (Grissell 1995). Crawford (1907a) listed a female specimen from Mexia, Texas as part of the material he examined. This specimen has not been found. It is the only voucher for the rearing from *Trigonorhinus*.

Microdontomerus anthonomi superficially resembles *M. parkeri*, but differs from that species distinctly in wing setation (cf. Figs. 5 and 6). It also resembles *M. anthidii*, from which it differs by characters outlined in the key.

Microdontomerus apianus Grissell, new species

Fig. 13

Holotype female.—Body length excluding ovipositor 3.0 mm, ovipositor 2.3 mm. Body black except: head dorsally with

slight metallic green tinge; yellow-orange are: scape, legs excluding coxae (fore and mesofemora slightly darkened); all tarsi whitish; wing veins brown. **Head**: Distance between eyes subequal to eye height; clypeus barely projecting beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 6:13:6; venter of toruli nearly on line with lower margin of eyes; toruli about own diameter apart; intermalar distance about 1.7× malar distance; eye height about 2.2× malar distance; antenna with pedicel laterally about 1.5× as long as broad apically, anellus nearly quadrate subequal in length to F1, funicle segments all wider than long, flagellum slightly wider distally than proximally but not noticeably spindle-shaped, scape almost reaching median ocellus. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina reduced and narrow; dorsellum slightly convex, with dense reticulate sculpture similar to propodeum; propodeum medially with pits along apical margin, with dense reticulate sculpture about as on scutellum, with distinct median carina extending from dorsal margin to nucha which is a narrow, arched polished carina, median carina subtended by obscure depression on either side, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle about its own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3.5× longest inner spiracle diameter; forewing (Fig. 13) ratio PV: MV:SV:SMV as 6:10:3:30, postmarginal vein about 0.6× marginal vein, costal cell below with 2 to 3 anterior setal rows, upper surface with few setae along anterior margin [difficult to see in any specimen]; basal setal line complete; cubital setal line with several setae absent basally (broken off, but complete in paratypes; i.e., basal cell closed,), with partial bare areas paralleling either side, dorsal area ending at about midpoint of marginal vein, ventral area ending at about apex of marginal vein; basal cell with 3 or 4 setae [complete row present in paratypes]; admarginal area partially defined by irregular posterior setal line, with about 12 wide spaced setae on bare area; parastigmal area and basal area bare; stigmal area setose to apex of postmarginal vein. **Metasoma**: T2 slightly emarginate at apico-median margin, remaining terga entire; ovipositor sheaths subequal in length to body including head, 2.5× as long as metatibia.

Male.—Body length 2.0 mm. Characters about as for female except: eye height 3× malar distance; scape ventrally flat and polished.

Variation.—In the paratype series, females vary in length from 3.0 to 3.8 mm. The ovipositor varies from about 2 to 3× as long as the metatibia. The extent of setation on the forewing is variable with the dorsal surface of the costal cell having a few setae along the anterior margin but these are very difficult to see. The setal row in the basal cell is partial to complete. A female from Nixon, Washoe County, Nevada, appears to be this species but is only 2 mm in length. The other characters are within the parameters of typical *M. apianus*, so I believe this small specimen belongs to this species, but I hesitate to include it (and a male from the same locality) in the type series without more material upon which to judge the extent of variation.

Type material.—Holotype ♀, Puente Hills, Los Angeles Co., California, February 26, 1926, Timberlake, found dead March 13, 1926, ex. *Megachile montivagus* [= *montivaga*] (UNSM); 12♀, 1♂ paratypes same data (UCR, USNM).

Other material examined.—Nevada: Washoe Co.: 1♀, 1♂ Nixon, F. D. Parker, reared from bee cell.

Etymology.—From the Latin "*apianus*", "of bees", in reference to the host.

Distribution.—Known from California.

Host.—Reared from *Megachile montivaga* (Megachilidae).

Discussion.—This species shares the following characters with *M. anthidii*: basal cell closed posteriorly (Fig. 13), costal cell above with setae along anterior margin (Fig. 13; more apparent in *anthidii*, Fig. 8), admarginal area of forewing sparsely setose, postmarginal vein about 0.7× marginal vein, toruli just above lower eye margin (as in Fig. 31), and short scape (one or more ocellus diameters from median ocellus). *Microdontomerus apianus* differs in having the intermalar distance about 1.7× the malar distance (about 2.5× in *M. anthidii*), and in having the ovipositor sheaths subequal to the body length and 2.0–3.0× as long as the metatibia (in *M. anthidii* ovipositor sheaths subequal to metasoma and usually less than 1.5× as long as metatibia, but in one questionable population nearly 2.0×).

Microdontomerus bicoloripes (Crawford)

Figs. 9, 36, 38

Antistrophoplex bicoloripes Crawford 1914:125. Lectotype ♀, designated by Grissell (1995: 204), Garden City, Kansas, USA (USNM); 5♀ paralectotypes same as lectotype.

Microdontomerus bicoloripes (Crawford): undesignated new combination by Grissell (1995: 204).

Lectotype female.—Body length excluding ovipositor 3.0 mm, ovipositor 2.2 mm. Body brown without metallic reflections; orange are: scape, pedicel, all legs including forecoxa; white are: wing veins, all tarsi. **Head**: Distance between eyes subequal to eye height; clypeus (Fig. 36) even with lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 11:23:8 (Fig. 38); torulus less than own diameter above lower margin of eyes; toruli about 1 diameter apart; intermalar distance about 1.8× malar distance; eye height about 2.3× malar distance; antenna with pedicel laterally about 1.7× as long as broad apically, anellus distinctly transverse, funicle segments all wider than long, flagellum slightly wider distally than proximally but appearing essentially parallel-sided, scape not reaching median ocellus and separated from it by about half an ocellus diameter. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina reduced and narrow; dorsellum more or less flat, with obscure wrinkled sculpture but no distinct carinae; propodeum laterally with obscure pits along anterior margin (perpendicular carinae present), medially flattened, with distinct carina extending from dorsal margin to nucha, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle about 0.5× own longest inner diameter from posterior margin of metanotum, median length of propodeum about 2× longest inner spiracle diameter; forewing (Fig. 9) ratio of PM:MV:SV:SMV as 20:40:11:70, postmarginal vein about 0.5× as long as marginal vein; costal cell below with 1 to 2 complete anterior setal rows, upper surface without setae; basal setal line with setae; cubital setal line with setae (i.e., basal cell closed), with partial bare areas paralleling either side, dorsal and ventral areas ending at about midpoint of marginal vein; basal cell with row of setae; admarginal area not defined by posterior line of setae, evenly covered with setae, parastigmal area and basal area bare; stigmal area bare to apex of postmarginal vein. **Metasoma**: MT2 slightly emarginate at apico-median margin; other terga entire; ovipositor sheaths slightly less in length than meso and metasoma, 2.5× as long as metatibia.

Male.—Body length 1.6 to 2.3 mm. Color as in female, except femora with metallic greenish black varying from basal half to near apex; scape varying from orange to orange infused with black, especially dorsally.

Variation.—Paralectotype females vary in length from 2.3 to 3.0 mm. The few oth-

er specimens range from 2.0 to 3.0 mm. The ovipositor varies from about 2.0 to 2.5× as long as the metatibia. Paralectotype females colored as in lectotype. In non-type females the body color varies from as in the paralectotypes to dark metallic greenish black and the legs vary from orange (as in the lectotype) to having varying amounts of metallic greenish black on the femora from the base to the apex.

Material examined.—Type material is detailed in the synonymy above. In addition I have seen 12♀ and 8♂ as follows (all USNM): Arizona: Maricopa Co.: 3♀, 6♂ Cave Creek, 10 May 1923, L. H. Weld, ex galls *Aulax* [= *Antistrophus*] *chrysothamni*. Iowa: Woodbury Co.: 2♀ Sioux City, C. S. Ainslie, reared from *Lygodesmia* sp. Kansas: Finney Co.: 6♀, 2♂ Garden City, 24 September 1913, C. H. Popenoe, ex cynipid galls on *Lygodesmia juncea*; Ellis Co.: 1♀ Elis, ex *Antistrophus pisum* [= *lygodesmiaepisum*] on *Lygodesmia* sp.

Distribution.—Known from Arizona, Kansas, and Iowa.

Host.—This species is associated with several species of *Antistrophus* (Cynipidae) galls on *Lygodesmia* (Asteraceae). The type series was reared from *Antistrophus* galls [stated in paper, but not on specimens] in Kansas. It has been reared from *A. chrysothamni* (Arizona) and *A. lygodesmiaepisum* in Kansas. Brandhorst (1943, 1964) discussed *M. bicoloripes* reared from the latter gall on *Lygodesmia juncea* (Pursh.) D. Don in Kansas (1943) Iowa (1964).

Discussion.—In 1995 I designated a lectotype for this species (Grissell 1995) without giving a reason for doing so. Crawford (1914) described this species from 6 females without designating a specimen as holotype. To insure nomenclatural stability I selected a single female as lectotype.

Microdontomerus bicoloripes is difficult to distinguish from *M. parkeri*, and their differences are discussed at length under the latter species.

Microdontomerus braconivorus Grissell, new species

Figs. 1, 15

Holotype female.—Body length excluding ovipositor 2.3 mm, ovipositor 0.3 mm. Body black except as follows: yellow are: fore and mesotibiae (metatibia medially shaded to black); whitish are: tarsi, wing veins. **Head**: Distance between eyes subequal to eye height; clypeus on line with lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 1:2.7:1; torulus slightly more than own diameter above lower margin of eyes; toruli slightly greater than 1 diameter apart; intermalar distance about 2.0× malar distance; eye height about 2.5× malar distance; antenna with pedicel laterally about as long as broad apically, anellus distinctly transverse, funicle segments all wider than long, flagellum slightly wider distally than proximally, clava not acuminate, scape not reaching median ocellus, separated from it by about one ocellus diameter. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina narrow, polished; dorsellum convex, reticulate with irregular carinae; anteromedian area of propodeum with several pits on either side of median carina, medially with complete carina reaching to nucha, nucha a narrow, lunate polished carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle about 1× own longest inner diameter from posterior margin of metanotum, median length of propodeum about 4× longest inner spiracle diameter; forewing (Fig. 15) ratio PV:MV:SV:SMV as 15:28:9:50, postmarginal vein about 0.6× marginal vein, costal cell below with 2 to 3 complete anterior setal rows and essentially covered except for small lunate area medially, upper surface with setae along anterior edge in distal third; basal setal line

Figs. 1–2. *Microdontomerus* spp.; female habitus.

complete; cubital setal line complete (i.e., basal cell closed), with bare areas paralleling either side, dorsal and ventral areas ending at about midpoint relative to marginal vein; basal cell with anterior setal row paralleling submarginal vein; admarginal area without posterior setal line, evenly covered with setae, parastigmal area and basal area bare; stigmal area with narrow bare surface to apex of postmarginal vein. **Metasoma**: Terga without emarginations at apico-median margin; ovipositor sheaths much shorter than metasoma, 0.5× as long as metatibia.

Male.—Body length 1.7 mm (all specimens). Color, sculpture, and other characters about as for female except: pro and mesotibiae white, metatibia apically white; F1-2 anelliform, club apically pointed; eye height about 3× malar distance.

Variation.—Females vary in length from 2.0 (ovipositor 0.3) to 2.5 (ovipositor 0.3) mm. There is no observable variation in the specimens available.

Type material.—Holotype ♀, New Mexico, Hildago Co., 14.7 mi. S Animas, coll. 14-VIII-2000, em 18 VIII-2000, J. P. Tuttle (USNM); 17♀, 4♂ same data as holotype (USNM).

Etymology.—From the host family stem "bracon" and "voro", meaning to eat.

Host.—Reared from *Aleiodes* sp. (Braconidae) in larva of *Sagenosoma elsa* on *Lycium pallidum* Miers (Solanaceae).

Discussion.—Microdontomerus braconivorus is recognized by its extremely short, barb-like ovipositor (Fig. 1), which is about half the length of the metatibia.

Microdontomerus buprestae Grissell, new species

Figs. 2, 25, 27, 41, 48

Holotype female.—Body length excluding ovipositor 3.0 mm, ovipositor 1.7 mm. Body black (without metallic sheen) except orange are: scape, tibiae, and tarsi; wings weakly shaded brown in distal 2/3, darker around parastigma and marginal vein. **Head:** Distance between eyes greater than eye height; clypeus (Fig. 27) projecting beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 4:9:3; dorsum of torulus on line with venter of eyes; toruli about 1 diameter apart; intermalar distance about 1.5× malar distance; eye height about 1.7× malar distance; antenna (Fig. 48) with pedicel laterally over 2.0× as long as broad apically, anellus elongate, subequal to F1, funicle segments wider than long, flagellum parallel-sided, scape not reaching median ocellus, separated from it by about half an ocellus diameter. **Mesosoma:** Scutellum dorsally flat but still convex, not in same plane as scutum; metanotum and propodeum in same plane but angled downward from plane of scutellum; posterior axillular carina narrow; dorsellum convex with slight median carina, with anterior and posterior row of pits (though these difficult to see and dorsellum appearing polished; propodeum covered with raised reticulation, with pits along anterior margin (Fig. 25) (perpendicular carinae present) becoming smaller towards outer margin, with strong but irregular median carinae extending from dorsal margin to nucha, nucha a narrow arched carina, median carina subtended by deep foveae, posterolateral corner of propodeum angulate (but not projecting) with distinct projecting denticle above it; spiracle subequal to own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing ratio PV:MV:SV:SMV as 10:17:6:45, postmarginal vein about 0.6× marginal vein, costal cell below with 1 to 2 complete anterior setal rows and nearly covered with setae, upper surface without setae; basal setal line complete; cubital setal line with few setae basally (i.e., basal cell partially closed but with complete setal line in paratypes), with partial bare areas paralleling both sides and ending at about midpoint of marginal vein; basal cell with complete setal row; admarginal area not

defined by posterior line of setae and with dense setae above, parastigmal and basal areas bare; stigmal area setose. **Metasoma:** MT2-6 (Fig. 41) deeply emarginate at apico-median margin; ovipositor sheaths shorter than mesosoma plus metasoma, 2.0× as long as metatibia.

Male.—Unknown.

Variation.—The few specimens exhibit no variation.

Type material.—Holotype ♀, 16.2 mi. E Prineville, Crook Co., Oregon, R. W. Westcott, summer 1977, ex *Chrysobothris* sp. in crown of *Erigonum compositum* (USNM); 2♀ paratypes with the same data (USNM).

Etymology.—Pertaining to the host family, Buprestidae, from which it has been reared.

Host.—Reared from *Chrysobothris* sp. (Buprestidae) in crown of *Erigonum compositum* Douglas ex Bentham (Polygonaceae).

Discussion.—*Microdontomerus buprestae* belongs to the group of species in which the scutellum is dorsally flattened and smooth (or at least less sculptured in contrast to the anterior of the scutum), the venter of the torulus is low on the face relative to the lower margin of the eye, and the ocellocular distance is greater than the longest lateral ocellus diameter. It is most readily distinguished by a small denticle or angle above the posterolateral corner of the propodeum. This denticle is not at the corner (as in Fig. 22 for *M. gordhi*) but above it (Fig. 25). Also, MT2-6 are deeply emarginate (Fig. 41), a state not found in most Nearctic species of the genus.

Microdontomerus ciscida Grissell, new species

Figs. 24, 30, 52

Holotype female.—Body length excluding ovipositor 1.9 mm, ovipositor 0.9 mm. Body metallic violet with blue reflections, except yellow are: scape, tibiae, and tarsi; wing veins brownish. **Head**: Distance between eyes slightly greater than eye height; clypeus about even with lateral corners of oral fossa (Fig. 30); ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 6:11:4; dorsum of torulus slightly above level of lower eye margin; toruli about own diameter apart; intermalar distance about 1.5× malar distance; eye height about 2.0× malar distance; antenna (Fig. 52♂) with pedicel laterally about 2× as long as broad apically, anellus transverse, half as long as F1, funicle segments wider than long, flagellum essentially parallel-sided [based on paratypes, holotype clava collapsed], scape not reaching median ocellus, separated from it by about half an ocellus diameter. **Mesosoma**: Scutellum almost flat, not in same plane as scutum; metanotum and propodeum in same plane but not in same plane as apex of scutellum; posterior axillular carina polished, narrow; dorsellum (Fig. 24) convex, with pits along anterior margin, posteriorly with small pits, medially with carina that appears to connect to median carina; propodeum (Fig. 24) angled with respect to scutellum, with pits along anterior margin (perpendicular carinae present) decreasing in size laterally, with distinct median carina subtended by deep pit on either side, carina extends from dorsal margin to nucha, which is obscured by carinae, posterolateral corner of propodeum somewhat angular and carinate but without distinct projecting denticle; spiracle subequal to own longest inner diameter from posterior margin of metanotum, median length of propodeum about 2.5× longest inner spiracle diameter; forewing ratio PV:MV:SV:SMV as 2:3:1:6, postmarginal vein about 0.6× marginal vein, costal cell below with 1 to 2 complete anterior setal rows and bare lunate area medially, upper surface with 1 or 2 setae at distal apical margin; basal setal line complete; cubital setal line with setae basally (i.e., basal cell closed), with partial bare areas paralleling ventral side, ending at about midpoint of marginal vein; basal cell with complete setal row and addition-

al setae paralleling submarginal vein; admarginal area not defined by posterior line of setae and with dense setae above, parastigmal and basal areas bare; stigmal area setose. **Metasoma:** Terga not emarginate at apico-median margin; ovipositor sheaths shorter than metasoma, 1.6× as long as metatibia.

Male.—Body length 1.4–1.7 mm. Color, sculpture, and other characters about as for female except: scape dorsally bluish; eye height about 2.5× malar distance; scape ventrally flat and polished, wider than in female, separated from midocellus by about an ocellus diameter; flagellum spindle-shaped (Fig. 52♂), basal flagellomeres reduced, wider than long, F1–2 "anellus-like", but with multiporous plate sensilla; clava pointed.

Variation.—Females range in length from 1.9 to 2.3 mm and display little variation except in the propodeum. The median carina of the dorsellum may be fairly obvious (as in the holotype) and appear to extend to the median carina of the propodeum. In some specimens the carina of the dorsellum is reduced and not apparently connected (or overlapping) the median propodeal carina. In females the scape may vary between specimens from yellow to darkish yellow.

Type material.—Holotype ♀, California, Berkeley, 5 Sept. 1937, B. M. Armitage (USNM); 9♀, 3♂ paratypes with same data (USNM).

Etymology.—From "cis", meaning weevil, and "-cida", to kill, in reference to the host of this species.

Host.—Reared from larva of *Lixus parcus* (Curculionidae).

Biology.—I have been unable to locate biological information relating to *Lixus parcus*, and there is little information on Nearctic species in general. According to Arnett et al. (2001) *Lixus* adults ". . . are associated with various plants in the Asteraceae and Polygonaceae". Chittenden (1930) described a species whose larvae lived in the roots of *Pluchea camphorata* (L.) and another "ovipositing on *Bidens*" (both Asteraceae). Ter-Minasyan (1978) summarized much information for Palearctic species of *Lixus* which ". . . lay eggs in the peduncle or the thinner parts of the stalk . . ." ". . . of the host plant where they are to complete their development". "Development of the larva and pupation takes place in the host plant". According to Ter-Minasyan, at least 15 families of plants are host to *Lixus*. In the Palearctic *Lixus* is particularly damaging to cole crops, beets, and many other cultivated plants.

Discussion.—*Microdontomerus ciscida* belongs to the group of species in which the scutellum is dorsally flattened and smooth (or at least less sculptured in contrast to the anterior of the scutum), the venter of the torulus is low on the face relative to the lower margin of the eye, and the ocellocular distance is greater than the longest lateral ocellus diameter. It is similar to *M. mysticus* in having the costal cell above with a row of setae along the anterior margin and the lateral ocellus diameter 1.5 to 2× the ocellocular distance. It differs as discussed in the key, and additionally is bright metallic blue to violaceous, whereas *M. mysticus* is black with only slight metallic reflections.

Microdontomerus darwini Grissell, new species

Figs. 34, 47

Holotype female.—Body length excluding ovipositor 2.3 mm, ovipositor ca 4.5 mm (curved over body and difficult to measure). Head and thorax brilliant metallic copper with shades of green, metasoma and coxae blackish copper; scape, pedicel, and legs beyond coxae bright orange; tarsi whitish; wing veins dark brown; admarginal area of wing with brown stain extending to basal setal line and cubital setal line. **Head:** Distance between eyes slightly less than eye height; clypeus (Fig. 34) obviously projecting beyond line connecting lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lat-

eral ocellus diameter 3:10:4; venter of torulus about on line with venter of eyes; toruli about own diameter apart; intermalar distance about 2.2× malar distance; eye height about 2.5× malar distance; antenna (Fig. 47) with pedicel laterally about 2× as long as broad apically, anellus about as long as broad, less than half as long as F1, funicle segments longer than wide (except F7, flagellum parallel-sided, scape nearly reaching median ocellus, clava pointed apically. **Mesosoma**: Scutellum flat, nearly in same plane as apex of scutum, metanotum and propodeum in same plane and almost in same plane as apex of scutellum; posterior axillular carina difficult to see, much reduced; dorsellum convex, with pits along anterior margin; propodeum with regular-sized pits along anterior margin, with indistinct median depression but no carina; posterolateral corner of propodeum smooth, rounded; spiracle subequal to own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3.5× longest inner spiracle diameter; forewing ratio PV:MV:SV:SMV as 3.5:6:2:14, postmarginal vein about 0.5× marginal vein, costal cell below with 1 to 2 complete anterior setal rows and bare lunate area medially, upper surface without setae; basal setal line complete; cubital setal line complete (i.e., basal cell closed), apically with partial bare areas paralleling ventral side, ending at about midpoint of marginal vein; basal cell with complete setal row; admarginal area not defined by posterior line of setae, with dense setae above, parastigmal and basal areas bare; stigmal area asetose. **Metasoma**: Laterally compressed, terga emarginate at apico-median margin; ovipositor sheaths longer than entire body, about 6× as long as metatibia.

Male.—Unknown.

Variation.—The two females are identical.

Type material.—Holotype ♀, California, Inyo County, Darwin Falls, 17 April 1970, E. E. Grissell (UCD), on *Eriogonum inflatum* (Polygonaceae); 1♀ paratype with same data (USNM).

Etymology.—This species is named in honor of the incomparable Charles Darwin, and not Darwin French, after whom the type locality was named.

Distribution.—Known only from the type locality.

Host.—No host is known.

Discussion.—This species is unique in having a broadly rounded, projecting clypeus (Fig. 34) and the ovipositor much longer than the entire body and about 6× as long as the metatibia. In other species the clypeus is at most slightly rounded (e.g., Figs. 27, 29) and the ovipositor is at most 2.5× as long as the metatibia. The face appears somewhat narrower than other species (Fig. 34), but it is about as wide as high by actual measurement whereas other species are at least slightly wider than high. In addition *M. darwini* has the flagellomeres mostly longer than broad (Fig. 47), the clava distinctly apically pointed (Fig. 47), and the forewing shaded brown between the marginal and cubital veins.

Microdontomerus eboreus Grissell, new species

Figs. 14, 17, 56

Holotype female.—Body length excluding ovipositor 1.9 mm, ovipositor 0.7 mm. Body black faint blue metallic reflections on head and propodeum; brownish are: lower half of face and mesosoma, coxae, base of metasoma; pale yellow are: basal half of femora; white are: scape, pedicel, flagellum, apical halves of femora, all tibiae, tarsi, wing veins. **Head**: Distance between eyes subequal to eye height; clypeus about on same line as lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 7:21:9; torulus ventrally on line with lower margin of eyes; toruli about 1 diameter apart; intermalar distance about 1.3× malar distance; eye height about 2.3× malar distance; antenna (Fig. 56♀)

with pedicel laterally about as long as broad, anellus distinctly transverse, F1 anellus-like, funicle segments all wider than long, flagellum slightly spindle-shaped, clava apically pointed, scape not reaching median ocellus and separated from it by about 1× ocellus diameter. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina narrow, flat, polished, but not flaring triangularly dorsally (Fig. 17); dorsellum convex, with obscure wrinkled sculpture and carinae; propodeum with row of pits along apical margin, pits largest medially growing smaller laterally, medially with complete delicate, nucha a narrow, lunate polished carina, posterolateral corner of propodeum rounded; spiracle slightly less than own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing (Fig. 14) ratio PV:MV:SV:SMV as 2:3:1:7, postmarginal vein about 0.6× marginal vein, costal cell below with 2 to 3 complete anterior setal rows, essentially covered except for small lunate area medially, upper surface without setae; basal setal line complete; cubital setal line complete (i.e, basal cell closed) with bare areas paralleling either side and ending about midpoint relative to marginal vein; basal cell with complete anterior setal row paralleling submarginal vein; admarginal area not defined by posterior line of setae, with dense setae above, parastigmal area and basal area bare; stigmal area with setae. **Metasoma**: Terga without apico-median emarginations; ovipositor sheath shorter than metasoma, about 1.3× as long as metatibia.

Male.—Body length 1.2 to 2.0 mm. About as for female except: flagellum distinctly spindle-shaped (Fig. 56♂); F1-3 reduced, nearly anelliform; in some specimens scape and flagellum with slight black infusion; basal half of femora infused with brown.

Variation.—Females vary in length from 1.6 to 2.4 mm. In some females the basal halves of femora are infused with brown. In both sexes the dorsellum varies from more or less smooth to having obscure wrinkles or carinae.

Type material.—Holotype ♀, 11 mi. N Portal, Cochise Co., Arizona, A. Zvirgzdins, 20 June 1976, ex *Deopalpus contiguus* on *Eucaterva variaraia* (USNM); 5♀, 3♂ paratypes, same data; 2♀, 2♂ paratypes, same data except 27 January 1976 (USNM).

Etymology.—From *eboreus*, meaning "of ivory", with reference to the white legs and antennae.

Distribution.—Known only from Cochise County in Arizona.

Host.—Reared from *Deopalpus contiguus* (Tachinidae) a primary parasitoid of *Eucaterva variaria* (Geometridae).

Biology.—*Microdontomerus eboreus* appears to be a hyperparasitoid of geometrids through their tachinid parasitoid. *Microdontomerus gordhi* was reared from the same geometrid host, but no mention was made of intermediary tachinids. Perhaps *M. gordhi* is a primary parasitoid and the two species have complimentary biologies with regard to the same primary host.

Discussion.—*Microdontomerus eboreus* is similar in appearance to *M. gordhi* with respect to the spindle-shaped antenna with clava apically pointed, the pedicel about as long as wide, and especially the axillular carina being slightly flattened, widened, and polished. In *M. eboreus* the axillular carina is parallel-sided but not expanded dorsally (Fig. 17), whereas in *M. gordhi* it expands dorsally into a triangular polished area (Fig. 18). Additionally, *M. eboreus* has the posterolateral corners of the propodeum rounded, whereas they are angulate in *M. gordhi* (Fig. 22). *Microdontomerus eboreus* is the only species in which the female and male have the antennae and legs (except sometimes bases of femora) concolorous white.

Microdontomerus enigma Grissell, new species

Figs. 7, 33, 43

Holotype female.—Body length excluding ovipositor 2.5 mm, ovipositor 2.2 mm. Body black with metallic green reflections except as follows: orange are: scape, all tibiae; brown are: wing veins, ovipositor sheaths; whitish are: all tarsi. **Head**: Distance between eyes subequal to eye height; clypeus (Fig. 33) projecting slightly beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 8:18:5; torulus barely above lower margin of eyes; toruli about 1 diameter apart; intermalar distance about 2.3× malar distance; eye height about 2.5× malar distance; antenna (Fig. 43♀) with pedicel laterally about 1.5× as long as broad apically, anellus transverse though slightly elongate, funicle segments slightly wider than long, flagellum slightly wider distally than proximally but essentially parallel-sided, scape not reaching median ocellus and separated from it by about an ocellus diameter. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina reduced and narrow; dorsellum more or less flat, with obscure median carina and lateral carinae that divide it into 4 weak depressions; propodeum with pits along anterior margin (perpendicular carinae present), medially flattened, with distinct carina extending from dorsal margin to nucha, nucha a narrow, arched polished carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle subequal to own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing (Fig. 7) ratio PV:MV:SV:SMV as 13:18:6:45, postmarginal vein about 0.75× marginal vein, costal cell below with 1 to 2 complete anterior setal rows, upper surface without setae; basal setal line essentially bare; cubital setal line bare basally (i.e., basal cell open), with partial bare areas paralleling either side, dorsal and ventral areas ending at about midpoint of marginal vein; basal cell without setae; admarginal area not defined by posterior line of setae and with 7 or 8 wide spaced setae above, parastigmal and basal areas bare; stigmal area with setae. **Metasoma**: MT2 faintly emarginate at apico-median margin; other terga entire; ovipositor sheaths slightly shorter than length of meso- plus metasoma, 2.2× as long as metatibia.

Male.—Body length 2.0 mm. Color, sculpture, and other characters about as for female except: eye height about 3× malar distance; scape ventrally flat and polished; flagellum distinctly widening apically (Fig. 43♂), flagellomeres wider than long; cubital setal line may be complete basally.

Variation.—Females vary in range from 2 to 3 mm. The ovipositor is constant at about 2–2.2× as long as the metatibia. Some female specimens have a few (1 to 3) bristles on the basal part of the cubital vein or in the basal cell, but generally the basal part of the wing is relatively asetose.

Type material.—Holotype ♀ Nixon, Washoe Co., Nevada, ex cell *Hoplitis bullifacies*, [no date] Frank Parker (# 3752H) (USNM); 21♀, 4♂ paratypes (deposited in USNM and USU): 6♀, 1♂ same data as holotype; 7♀ same data except Patrick, #3727B; 2♀ same data except #3727H; 6♀, 3♂ same data except #3836C.

Etymology.—From "*enigma*", Latin for "obscure", in reference to the cryptic nature of this species.

Distribution.—*Microdontomerus enigma* is known only from Washoe County, Nevada.

Hosts.—All specimens were reared from *Hoplitis bullifacies* (Megachilidae).

Discussion.—This species is phenotypically nearly identical to *M. parkeri*. In *M. enigma* the postmarginal vein (Fig. 7) is

about 0.75× as long as the marginal vein (about 0.5× in *M. parkeri*, Fig. 6) and the admarginal area (Fig. 7) is not well delimited posteriorly and is covered with wide-spaced setae (well delimited posteriorly and with few setae in *M. parkeri*, Fig. 6). Somewhat more difficult to assess is that in *M. enigma* the longest diameter of the lateral ocellus is less than the ocellocular distance, whereas it is subequal to or greater than in *M. parkeri* (Fig. 39).

Microdontomerus fumipennis Crawford

Microdontomerus fumipennis Crawford 1916:141–142. Lectotype ♀, designated by Grissell (1995: 204), Maxwell, New Mexico (USNM, examined); 7♀, 3♂ paralectotypes same as lectotype.

Lectotype female.—[Characters in brackets are from the paralectoypes because the lectotype has some areas covered by glue.] Body length excluding ovipositor 3.0 mm, ovipositor 1.4 mm. Body black without metallic reflections; orange are: scape, pedicel, apices of femora, tibiae, tarsi; brownish are: wing veins; central area of forewing. **Head**: Distance between eyes slightly greater than eye height; clypeus on same line as lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 7:18:7; venter of torulus at lower margin of eyes; toruli about 1 diameter apart; intermalar distance about 1.5× malar distance; eye height about 2× malar distance; antenna with pedicel laterally about 1.5× long as broad, anellus distinctly transverse, funicle segments all wider than long, flagellum parallel-sided, scape barely reaching median ocellus. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina reduced and narrow; dorsellum more or less flat, with strong irregular carinae dividing it into many irregular pits; [propodeum with row of pits along apical margin, pits largest medially growing smaller laterally, medially with complete strong carina, nucha a narrow, lunate polished carina, posterolateral corner of propodeum rounded; spiracle subequal to own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3–4× longest inner spiracle diameter]; forewing ratio PV:MV:SV:SMV as 9:13:5:30, postmarginal vein about 0.7× marginal vein, costal cell below with 2 to 3 complete anterior setal rows, essentially covered except for small lunate area medially, upper surface without several setae along anterior margin; basal setal line complete; cubital setal line setose in basal cell (i.e., basal cell closed), with bare areas paralleling either side and ending at about midpoint of marginal vein; basal cell with incomplete anterior setal row paralleling submarginal vein; admarginal area not defined by posterior line of setae, evenly covered with setae, parastigmal area and basal area bare; stigmal area with setae. **Metasoma**: [MT2-3 entire, without emargination at apico-median margin], remaining terga entire; ovipositor sheaths shorter than metasoma, about 1.5× as long as metatibia.

Paralectotype males.—Body length 1.5 to 2.0 mm. About as for female except: flagellum slightly wider apically; scape ventrally flattened and polished; F1 reduced, nearly anelliform.

Variation.—Females in the type series range from 2 to 3 mm excluding the ovipositor. Other material examined ranges from 1.5 to 3.5 mm. The amount of shading in the forewing varies from weakly to strongly stained.

Material examined.—I have seen 83♀ and 7♂ from the following locations (all in USNM unless marked otherwise): Arizona: Pima Co.: 2♀ Sabino Canyon, 6 April 1957, F. Werner, G. Butler, ex cocoons *Malacosoma fragile*; 1♀ same data except, 25 April 1953, 1965, ex. *Malacosoma* sp.; 1♀ Tucson, 8 April 1971, R. Robbins, ex cocoon *Malacosoma incurva*; 6♀, 2♂ [no town], Hwy. 83, em. 18–21 June 1984, ex. Ophioninae cocoon in cocoon of *Agapema*

galbina anona. California: Napa Co.: 21♀ Glen Ellen, ex pupa "*Hem. vetusta*" (= *Orgyia vetusta*) (UCR); San Luis Obispo Co.: 9♀ 6 mi. SE Pozo, 23 April 1989, W. E. Wahl; Santa Barbara Co.: 1♀ Bluff Camp, San Rafael Mts., 29 June 1959, P. M. Marsh (UCD); Solano Co.: 2♀ Cold Canyon Reserve, 11 km W Winters, 7–17 May 1991, D. Carmean, Malaise trap (UCD); 1♀ same locality, 17 July 1993, S. L. Heydon, on *Dacus* sp. (UCD); Sonoma Co.: 11♀, 1♂ [no town], ex *Clisiocampe thoracica*; Tuolumne Co.: 1♀ Tuolumne City, 25 June 1971, N. J. Smith (UCD). Colorado: Arapahoe Co.: 1♀ [no town], S. Yosemite Str., coll. 25 July 1992, T. Eckberg, em. August 1982, ex *Exorista mella*; Costilla Co.: 3♀, 1♂ Jarosa, Sept. 1985, S. Stone, D. Swift, ex *Hemileuca magnifica* (or hyper in tachinid). Montana: Ravalli Co.: 4♀ Darby, 31 July 1922, ex fruit tree leafroller. New Mexico: Union Co.: 5♀ Clayton, 28 Sept. 1976, E. Huddleston, ex. *Hemileuca oliviae*. Oregon: Josephine Co.: 2♀, 2♂ Kerby, July 1938, R. L. Furniss, *Ceanothus* sp.; Klamath Co.: 3♀, 1♂ Cave Mountain, 2 June 1985, ex *Rhyacionia zonata* on *Pinus ponderosa*. Utah: Salt Lake Co.: 3♀, 1♂ Granite, 5 July 1936, W. M. Allen, ex dewberry leafroller; 1♀ Monroe, 7 November 1967, Baker-Sandin, ex *Malacosoma*. Washington: Stevens Co.: 1♀ Northport, 4 June 1930, DeDelon, ex *Hemerocampa pseudotsugae*; 1♀ same, ex ichneumonid in tussock moth pupa. Wyoming: Albany Co.: 1♀ Medicine Bow National Forest, along Happy Jack Hwy., coll. 27–28 June 2000, em. 3–10 July 2000, S. Shaw, ex ?*Alciodes malacosomatos* in larva of *Malacosoma disstria*; Sublette Co.: 1♀ Pinedale, 26 June 1961, Stehr, *Malacosoma californica*; county unknown: 1♀, 1♂ Lyle, 28 June 1936, R. L. Furniss, on *Quercus garryana*.

Distribution.—This species is widespread in the western United States.

Hosts.—The type series was reared from *Malacosoma fragile* (now = *californicum fragile*) (Lasiocampidae). Knowlton and Allen (1937) reported it from *Choristoneura rosaceana* (Tortricidae). Niwa (1988) reared it from *Rhyacionia zonana* (Tortricidae) (examined) on *Pinus ponderosa* C. Lawson (Pinaceae). Peigler (1985) reported it from an Ophioninae cocoon (Ichneumondiae) within the cocoon of *Agapema galbina anona* (Saturniidae) (examined) and from *Hemileuca magnifica* (Saturniidae) (Peigler 1994). Witter and Kulman (1972) summarized earlier literature resources for this species.

New rearing records for this species are (all USNM unless otherwise stated): *Exorista mella* (Tachinidae); *Hemileuca olivae* (Saturniidae), *Orgyia pseudotsugata, O. vetusta* (Lymantriidae) (UCR); *Archips argyrospila* (fruittree leafroller) (Tortricidae); *Malacosoma incurvum, Malacosoma disstria* (Lasiocampidae) (probably from *Alciodes malacosomatos* (Braconidae) in the larval host mummy); ichneumonid in tussock moth (Lasiocampidae).

Biology.—Witter and Kulman (1972) treated *M. fumipennis* as an egg parasite based upon Langston (1957), but Langston does not mention anything about life stages attacked so the notion is completely invalid. Peigler (1985) demonstrated that this species was a hyperparasite, possibly in a facultative manner. Scott Shaw (pers. comm.) reared this species from suspected *Alciodes malacosomatos* (Hym: Braconidae) in the larval host mummy of *Malacosoma disstria*. Niwa (1988) reported *M. fumipennis* as an extremely rare parasitoid (4 specimens from 4500 host pupae) which attacked host pupae in the fall and emerged in the spring.

Discussion.—In 1995 I designated a lectotype for this species (Grissell 1995) without giving a reason for doing so. Crawford (1916) described this species from 8 females and 3 males without designating a specimen as holotype. To insure nomenclatural stability I selected a single female as lectotype.

Microdontomerus fumipennis appears similar to *M. gordhi* in size and coloration. The former, however, has the costal cell

setose along the dorsal anterior margin and the latter does not. Additionally, *M. fumipennis* has a narrow axillular carina (as in Fig. 16) as opposed to the widened carina in *M. gordhi* (Fig. 18) and the forewing is lightly infumate posterior to the marginal vien, whereas it is hyaline in *M. gordhi*. In *M. fumipennis* the ovipositor is about 1.4 to 1.5× the metatibia, whereas in M. gordhi it is about 1.1 to 1.2× the metatibia.

Microdontomerus gordhi Grissell, new species

Figs. 11, 18, 22, 51

Holotype female.—Body length excluding ovipositor 2.4 mm, ovipositor 0.7 mm. Body black without metallic reflections; orange are: scape, pedicel, flagellum, apices of femora, all tibiae; whitish are: all tarsi, wing veins. **Head**: Distance between eyes slightly greater than eye height; clypeus on same line as lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 6: 17:7; torulus slightly above lower margin of eyes; toruli about 1 diameter apart; intermalar distance about 1.5× malar distance; eye height about 2× malar distance; antenna (Fig. 51♀) with pedicel laterally about as long as broad, anellus distinctly transverse, funicle segments all wider than long, flagellum more or less parallel-sided, scape not reaching median ocellus and separated from it by about 0.5× ocellus diameter. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina wide, flat, and polished (Fig. 18); dorsellum convex, with obscure wrinkled sculpture and carinae; propodeum with row of pits along apical margin, pits largest medially growing smaller laterally, medially with complete delicate carina, nucha a narrow, lunate polished carina, posterolateral corner of propodeum distinctly angulate (Fig. 22); spiracle about 0.5× own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing (Fig. 11) ratio PV:MV:SV:SMV as 2:3:1:7, postmarginal vein about 0.7× marginal vein, costal cell below with 2 to 3 complete anterior setal rows, essentially covered except for small lunate area medially, upper surface without setae; basal setal line complete; cubital setal line sparsely setose in basal cell (i.e., basal cell closed based on paratypes), with bare areas paralleling either side and ending at about midpoint of marginal vein; basal cell with complete anterior setal row paralleling submarginal vein; admarginal area not defined by posterior line of setae, evenly covered with setae, parastigmal area and basal area bare; stigmal area with setae. **Metasoma**: MT2-3 slightly emarginate at apico-median margin, remaining terga entire; ovipositor sheaths shorter than metasoma, about 1.2× as long as metatibia.

Male.—Body length 1.7 mm. Similar to female except: flagellum spindle-shaped (Fig. 51♂); F1 reduced, nearly anelliform; cubital vein complete (i.e., not interrupted at junction with basal vein.

Variation.—Females vary in length from 2.4 to 2.7 mm and the ovipositor from about 1.1 to 1.2× the metatibia. The cubital vein of the holotype is interrupted (i.e., bare with several setae missing) at its junction with the basal vein, but in some specimens it appears that only one or two setae are missing. The basal cell is basically "closed" posteriorly, but to varying degrees of completeness. The pit on either side of the median carina varies from nearly absent (indicated by a carina and slight depression) to nearly as strong as shown in Fig. 15.

Type material.—Holotype ♀, California, Riverside Co., Whitewater Canyon, October 1978, G. Gordh, ex pupa *Eucaterva variaria* (USNM); 16♀, 1♂ paratypes with same data (UCR, USNM).

Etymology.—Named for Gordon Gordh, the collector.

Host.—Reared from *Eucaterva variaria* (Geometridae).

Discussion.—*Microdontomerus gordhi* is similar in appearance to *M. fumipennis* especially in the dense setation of the admarginal area of the forewing. Methods to separate the two species are given under the latter. Additionally in *M. gordhi* the lateral corners of the propodeum are angulate and slightly projecting (Fig. 22) whereas in other species (except *M. buprestae*, Fig. 25) they are at most broadly acute (Figs. 23, 24).

Microdontomerus hemileucae Grissell, new species

Figs. 10, 32, 50

Holotype female.—Body length excluding ovipositor 1.5 mm, ovipositor 0.7 mm. Body black except as follows: pale yellow are: scape, fore and mesotibiae (metatibia shaded to black); brown are: flagellum; whitish are: tarsi, wing veins. Head and mesosoma (excluding metanotum) nearly evenly covered with reticulate sculpture; metasomal terga finely, distinctly reticulate laterally and dorsally. **Head**: Distance between eyes subequal to eye height; clypeus (Fig. 32) on line with lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 1:3:1; torulus slightly less than own diameter above lower margin of eyes; toruli about 1 diameter apart; intermalar distance about 1.8× malar distance; eye height about 3× malar distance; antenna (Fig. 50) with pedicel laterally about as long as broad apically, anellus distinctly transverse, F1 ringlike but with placoids, funicle segments all wider than long, flagellum slightly wider distally than proximally, scape not reaching median ocellus and separated from it by about one ocellus diameter. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina reduced, inconspicuous; dorsellum somewhat convex, with obscure wrinkled sculpture in upper half, posterior margin transversely depressed; anteromedian area of propodeum without pits, but pits begin laterally near lateral edge of dorsellum, medially with complete carina reaching to nucha, nucha a narrow, lunate polished carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle about 1× own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing (Fig. 10) ratio PV: MV:SV:SMV as 17:30:10:67, postmarginal vein about 0.6× marginal vein, costal cell below with 2 to 3 complete anterior setal rows, essentially covered except for small lunate area medially, upper surface without setae; basal setal line complete; cubital setal line complete (i.e., basal cell closed), with bare areas paralleling either side, dorsal area ending at about midpoint relative to marginal vein, ventral area ending at about apex relative to marginal vein; basal cell with partial anterior setal row paralleling submarginal vein; admarginal area defined posteriorly by irregular row of setae, area with 3 or 4 setae, parastigmal area and basal area bare; stigmal area with narrow bare surface to apex of postmarginal vein. **Metasoma**: Terga without emarginations at apico-median margin; ovipositor sheaths shorter than metasoma, 1.3× as long as metatibia.

Male.—Body length 1.0 to 1.7 mm. Color, sculpture, and other characters as for female except: distance between eyes less than eye height; eye height nearly 4× malar distance.

Variation.—Females vary in length from 1.3 (ovipositor 0.6) to 1.9 (ovipositor 0.7) mm. In smaller female and all male specimens the distance between the eyes becomes slightly narrower than the eye height.

Type material.—Holotype ♀, 7 mi. E El Sueco, Chihuahua Municipality, Chihuahua State, June 1983, G. Fritz, ex eggs of *Hemileuca oliviae* (USNM); 54♀, 16♂ para-

types, same data as holotype (USNM, CNC, BMNH).

Other material examined.—Mexico: Baja California Sur: 2♀, 4♂ San Ignacio, 25 August 1994, S. L. Heydon (UCD).

Etymology.—Named for its association with the range caterpillar, *Hemileuca oliviae*.

Distribution.—The species is known so far only from northern Mexico (Chihuahua, Baja California Sur).

Hosts.—This species was reared from eggs of *Hemileuca oliviae* (Saturniidae) and from eggs of an unknown, field-collected pentatomid (reported in Fritz et al. 1986). I have not seen material reared from the pentatomid.

Biology.—Although this species was reared from eggs of *Hemileuca oliviae* it is not certain if it is a true egg parasitoid or possibly a hyperparasitoid (Peigler 1994). The eggs of *H. oliviae* are commonly infested with the parasitoid *Anastatus semiflavidus* (Eupelmidae) (Watts and Everett 1976, Fritz et al. 1986, Mendel et al. 1987). Evidence from egg dissections proved inconclusive, but Fritz et al. (1986) demonstrated that both *A. semiflavidus* and *M. hemileucae* (as *Microdontomerus* sp.) parasitized embryonated eggs. From field collected *Hemileuca* eggs Fritz et al. (1986) reared 1367 adults of *Anastatus* but only 102 adults of *Microdontomerus*. Much reduced numbers of the latter relative to the former is a possible indication of hyperparasitism. Perhaps significantly, *M. hemileucae* did not oviposit into or emerge from laboratory reared eggs of *Hemileuca*, whereas *A. semiflavidus* did, thus indicating possible hyperparasitoid behavior for *M. hemilucae* (Fritz et al. 1986). Watts and Everett (1976) noted that *A. semiflavidus* had been an important natural enemy of *H. oliviae*, but that its effectiveness had decreased by the 1970's. They did not find any egg parasitoid other than *A. semiflavidus*. *Microdontomerus hemileucae* was first discovered in the early 1980's (Fritz et al. 1986) and may have been a factor in the decline of *A. semiflavidus* and its effectiveness.

Fritz et al. (1986) reared both *A. semiflavidus* and *M. hemileucae* from field collected pentatomid eggs and suggested that the pentatomid might serve as an alternate host. Coreid eggs were reported to be parasitized by *A. semiflavidus* (Watts and Everett 1976) and thus also might be an expected host for *M. hemileucae* as well.

In *Microdontomerus*, egg parasitism is known for *M. ovivorus* (Steffan) reared from buprestid eggs in Algeria (Steffan 1967) and for *M. senegalensis* (Risbec) reared from praying mantid egg cases in Senegal (Risbec 1951). Material of *M. senegalensis* later reported by Risbec (1954) and examined by me, contained an associated specimen of *Podagrion* (Torymidae), which is a common parasitoid of mantid eggs, and thus it is possible that *M. senegalensis* is a parasitoid of *Podagrion* rather than of the mantid eggs themselves.

Discussion.—*Microdontomerus hemileucae* keys out with *M. bicoloripes* based on their sparsely setose admarginal area of the forewing and lack of dorsal anterior setal row in the costal cell. The characters given in the key will further aid in separating the two species. In addition the two species are distinct in coloration, with the former having pale yellow markings with the metatibia nearly black and the latter having orange markings with the metibia orange.

Microdontomerus mysticus Grissell, new species

Figs. 3, 12, 35, 42

Holotype female.—Body length excluding ovipositor 3.5 mm, ovipositor 1.0 mm. Body black with very slight metallic bluish purple reflections except orange are: scape, pedicel, tibiae, and tarsi; wings weakly shaded brown in distal ¾. **Head:** Distance between eyes subequal to eye height; clypeus (Fig. 35) projecting beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lat-

Figs. 3–4. *Microdontomerus* spp.; female habitus.

eral ocellus diameter 4:8:3; dorsum of torulus about half own diameter lower than eyes; toruli about 1 diameter apart; intermalar distance about 2.0× malar distance; eye height about 2.0× malar distance; antenna (Fig. 46) with pedicel laterally about 2× as long as broad apically, anellus quadrate, slightly shorter than F1, funicle segments wider than long, flagellum essentially parallel-sided, scape not reaching median ocellus, separated from it by about an ocellus diameter. **Mesosoma:**

Scutellum flat, not in same plane as scutum; metanotum and propodeum flat and in same plane but not in same plane as apex of scutellum; posterior axillular carina reduced and narrow; dorsellum convex, without median carina or pits; propodeum subhorizontal, with several small pits along anterior margin (perpendicular carinae present), with distinct median carina subtended by deep pits on either side, carina extends from dorsal margin to nucha, which is narrow, arched carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle subequal to own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing (Fig. 12) ratio PV:MV:SV:SMV as 8: 15:6:40, postmarginal vein about 0.5× marginal vein, costal cell below with 1 to 2 complete anterior setal rows and nearly covered with setae, upper surface with setae row along distal 2/3 of apical margin; basal setal line complete; cubital setal line with setae basally (i.e., basal cell closed), with partial bare area paralleling ventral side (but not dorsal), ending at about midpoint of marginal vein; basal cell with complete setal row and additional setae paralleling basal setal line; admarginal area not defined by posterior line of setae and with dense setae above, parastigmal and basal areas bare; stigmal area setose. **Metasoma:** MT2 (Fig. 42) slightly emarginate at apico-median margin, other terga without emarginations; ovipositor sheaths shorter than metasoma, 1.4× as long as metatibia.

Male.—Unknown.

Variation.—The few females at my disposal show little variation. The forewing shading appears strongest in the holotype and absent in several other specimens as well as the material from *Crossidius*. One specimen from the latter host has the ovipositor nearly 1.8× as long as metatibia. The two specimens from *Crossidius* appear to have the pedicel slightly narrower (and thus relatively longer) in dorsal view than specimens from *Dudleya*.

Type material.—Holotype ♀, "Mexico, San Ysidro, Cal.", 22 September 1947, "ex *Dudleya*" (USNM); 5♀ paratypes with same data (USNM). 2♀ paratypes, Nevada, Elko Co., 10 mi. SE Halleck, 27-VIII-1959, Bechtel, Kingsolver, coll., ex pupae of *Crossidius hirtipes*.

Etymology.—From "*mysticus*", Latin for "secret", in reference to the inexact locality and host data for the holotype.

Distribution.—The species is known from Nevada, but the other locality record is cryptic. San Ysidro is located in San Diego County near the Mexican/California border at Tijuana. According to Rick Westcott (pers. comm.) the specimens were probably "from material intercepted at the border station" and really came from NW Baja California.

Host.—Specimens reared from the plant *Dudleya* (Crassulaceae) have no stated host. According to Rick Westcott (pers. comm.) an undescribed species of *Chrysobothris* (Buprestidae) is known from *Dudleya* in the San Diego/Baja area. Additionally, according to Westcott, a pyralid moth and an anobiid beetle also have been reared from the host plant. Given the very similar appearance and flattened habitus of this species relative to *M. westcotti* and *M. buprestae*, both of which attack buprestids, and *M. ciscida*, which attacks weevils, I suspect that *M. mysticus* most likely attacks beetles. Its rearing from pupae of *Crossidius hirtipes* (Cerambycidae) suggests that it may be a generalist on plant boring beetle larvae.

Discussion.—*Microdontomerus mysticus* belongs to the group of species in which the scutellum is dorsally flattened and smooth (or at least less sculptured in contrast to the anterior of the scutum), the venter of the torulus is low on the face relative to the lower margin of the eye, and the ocellocular distance is greater than the longest lateral ocellus diameter. In size and coloration, *M. mysticus* is phenotypi-

cally similar to *M. buprestae*, but differs from that species by characters given in the key. It keys to the same couplet as *M. ciscida*, but differs as discussed under that species. Additionally, *M. mysticus* is nearly twice as long as the latter species.

Microdontomerus parkeri Grissell, new species

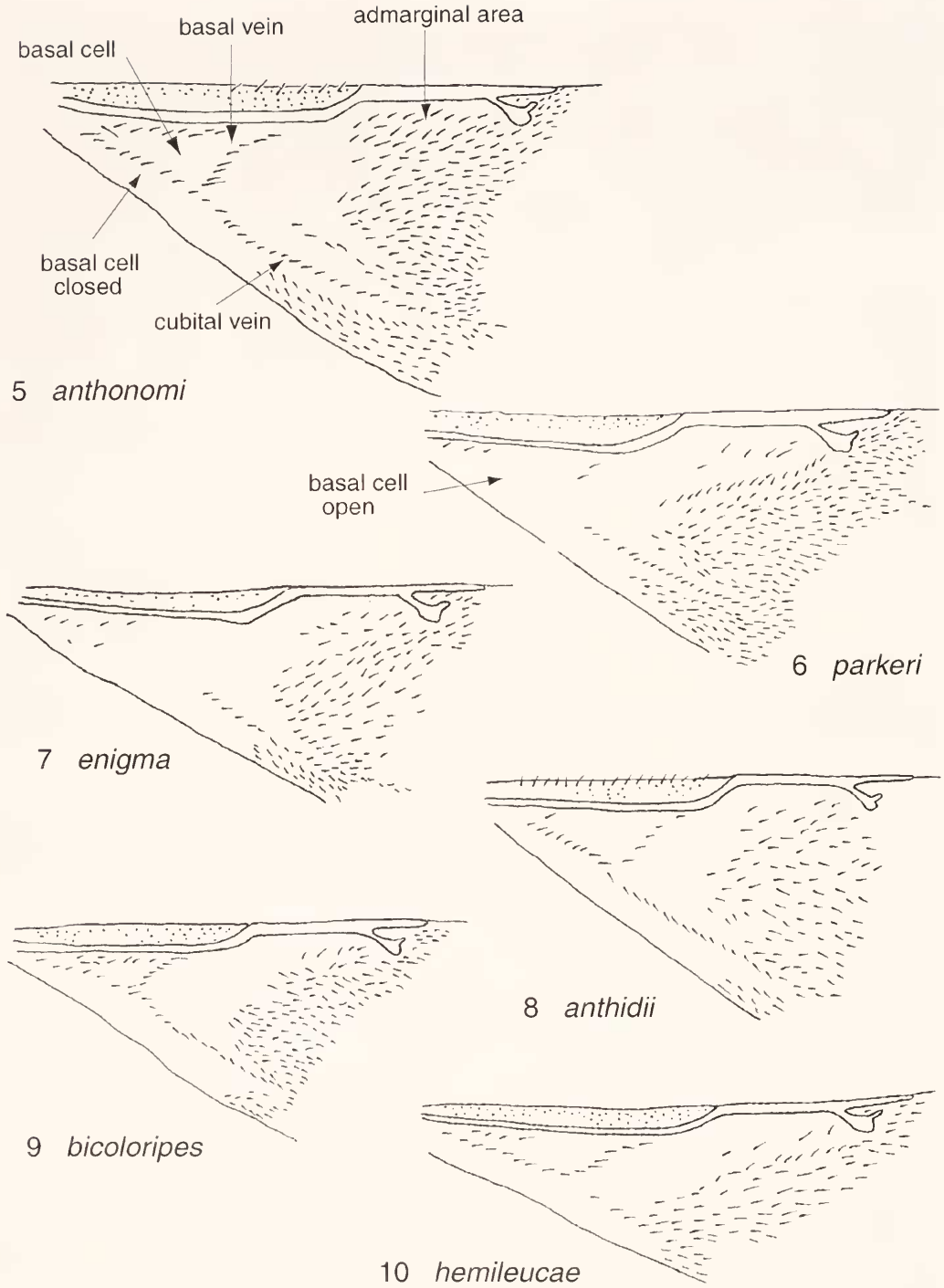
Figs. 6, 23, 28, 39, 55

Holotype female.—Body length excluding ovipositor 3.1 mm, ovipositor 1.8 mm. Body black with metallic green reflections except as follows: orange are: scape, pedicel, all tibiae, forefemur, apical half of meso- and metafemora; brown are: wing veins, ovipositor sheaths; whitish are: all tarsi. **Head:** Distance between eyes shorter than eye height; clypeus (Fig. 28) projecting slightly beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 10:28:11 (Fig. 39); torulus less than own diameter above lower margin of eyes; toruli about 1 diameter apart; intermalar distance about 1.8× malar distance; eye height about 2.3× malar distance; antenna (Fig. 55) with pedicel laterally about 1.5× as long as broad apically, anellus distinctly transverse, funicle segments all wider than long, flagellum slightly wider distally than proximally but appearing essentially parallel-sided, scape not reaching median ocellus and separated from it by about half an ocellus diameter. **Mesosoma**: Scutellum convex, not in same plane as scutum; metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina reduced and narrow; dorsellum (Fig. 23) more or less flat, with distinct median carina and lateral carinae that divide it into 3 or 4 deep irregular depressions; propodeum (Fig. 23) laterally with pits along anterior margin (perpendicular carinae present), medially flattened, with distinct carina extending from dorsal margin about half way where it forks, left fork strongly branched to nucha, right fork weak and obscure, nucha a narrow, arched polished carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle subequal to own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing (Fig. 6) ratio of PM:MV:SV:SMV as 17:35:9:70, postmarginal vein about 0.5× as long as marginal vein; costal cell below with 1 to 2 complete anterior setal rows, upper surface without setae; basal setal line essentially bare with 1 or 2 setae; cubital setal line bare basally (i.e., basal cell open), with partial bare areas paralleling either side, dorsal and ventral areas ending at about midpoint of marginal vein; basal cell with several setae basally, but no row; admarginal area defined by posterior line of setae and with 5 setae above, appearing almost bare, parastigmal and basal areas bare; stigmal area bare to apex of postmarginal vein. **Metasoma**: MT2 slightly emarginate at apico-median margin; other terga entire; ovipositor sheaths subequal in length to metasoma, 2.0× as long as metatibia.

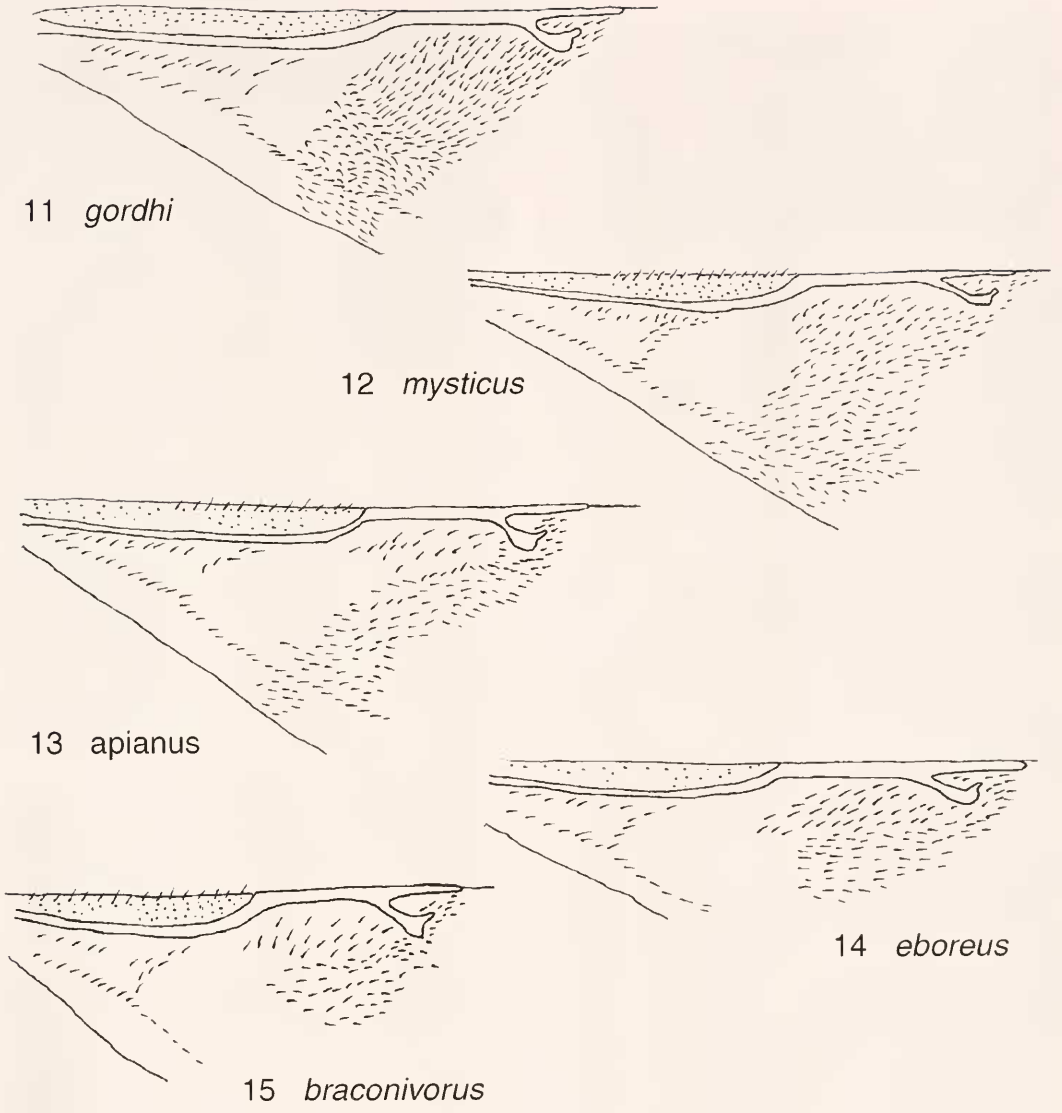
Male.—Body length 1–2 mm. Color, sculpture, and other characters about as for female except: scape ventrally flat and polished; basal setal line may be nearly complete.

Variation.—Females vary in range from 1.5 to 3 .0 mm. In females, individuals from single rearings appear to range in length about as follows: 1.5–2.0 mm; 2.0–2.5 mm; 2.5–3.0; and 2.0–3.0 mm; (number of populations sampled = 45). I did not see any populations in which the extremes (ca. 1.5 to 3.0 mm) were found. In all cases, the female ovipositor averaged about 2× the metatibia in length. Males were always slightly smaller. The lateral ocellus diameter ranged from slightly smaller to slightly larger than the ocellocular distance.

Both body and leg color are extremely variable within and between populations of this species. Body color in larger spec-



Figs. 5–10. *Microdontomerus* spp., basal portion of forewing, dorsal view showing setation (except costal cell also showing ventral setation as dots).



Figs. 11–15. *Microdontomerus* spp., basal portion of forewing, dorsal view showing setation (except costal cell also showing ventral setation as dots).

imens (over 2.5 mm) varies from black with green metallic reflections, to coppery or reddish green. In smaller specimens the body is generally black but some specimens may have metallic green reflections. The leg (excluding coxae) coloration varies from all orange to various gradations of orange on the femora as follows: forefemur orange in apical half (black basally) with mid and metafemora orange; forefemur tipped orange with meso- mid and metafemora orange; fore- and mesofemora black tipped orange with hind femora orange; all femora black with the apex straw color.

The wing setation is slightly variable around the basic pattern shown in Fig. 6. The basal cell may have 4 or 5 setae, the basal setal line may have 3 or 4 setae, and the admarginal area may have a couple

more or less setae than shown. The admarginal area may be posteriorly defined by a distinct, single straight row of setae or this line may be slightly obscure, but it is a distinct largely bare area with few setae. The stigmal area is usually bare, but occasional specimens will have at most one seta in the area. The basal cell is always open posteriorly. In general the wing appears bare in the basal half, regardless of the number of specific setae involved.

On extremely tiny specimens (less than 1.5 mm), a weak, single median propodeal carina is present but may be visible only at certain angles of view. In large specimens (more than 3.0 mm) the median carina varies from a single, distinct carina to an inverted V-shaped carina that reaches from the dorsellum to the nucha and sometimes (as in the case of the holotype) one or more forked carinae may be obscure.

Type material.—Holotype ♀, Brown Canyon, Kern Co., California, ex cell *Osmia marginata* Cresson, Frank Parker, (FP #2083E) (USNM); 89♀, 51♂ paratypes from the following localities (all collected by F. D. Parker and deposited in USNM, CNC, BMNH, USU): California: Imperial Co.: 2♀ Glamis, ex cell *Hoplitis palmarum* (FP #2320B). Kern Co., Sand Canyon (3 mi. W Brown): 4♀, ex cell *Ashmeadiella cubiceps* (FP #4188D); 15♂ ex cell *Ashmeadiella* sp. (FP #4183A); 5♀, 2♂ same data as holotype. Riverside Co.: 5♀ 18 mi. W Blythe, ex cell *Ashmeadiella* sp. (FP #2954A); Thousand Palms, 4♀, 2♂ ex cell of *Ashmeadiella rufipes* (FP #4532); 10♀, 6♂ex cell of *Ashmeadiella bigeloviae* (FP #4531A); 6♀, 1♂ ex nest of *Ashmeadiella rufipes* (FP #4527); 10♀, 7♂ White Water, ex cell *Osmia marginata* (FP #2456B). San Bernardino Co.: 8♀, 1♂ Krammer Junction, ex cell *Ashmeadiella cubiceps* (FP #4369G); 4♀, 5♂ same data (FP #4333J). Yolo Co.: 6♀ Davis, ex cell *Megachile brevis* Say (FP #1384). Nevada: Churchill Co.: 5♀, 1♂ 12 mi. NE Stillwater, ex cell *Ashmeadiella gillettei* (FP #3126B); Washoe Co.: 5♀, 3♂ Nixon, ex cell *Ancistrocerus* (FP #4015G); 5♀, 6♂ Patrick, ex cell *Hoplitis bullifacies* (FP #3665); 10♀, 2♂ Wadsworth, ex cell *Ashmeadiella rufipes* (FP #3584D).

Other material examined.—In addition to the type material, I have seen the following: Arizona (USNM unless specified otherwise): Gila Co.: 17♀, 9♂ 2.5 mi. E Verde River, bordering Hwy 87, em 29 March to 24 April 1963, Cazier, Mortenson; La Paz Co.: 10♀, 2♂ 2.8 mi. E Parker, coll. 9 May 1963, em. 26 May 1963, "green plug", Cazier, Mortenson; 9♀, 2♂ same data except em. 23 May, galls *Hilaria rigida*, "resin pobble" [? = pebble]. California: 8♀, 4♂ Imperial Co.: Glamis, coll. January 1964, F. Parker, ex *Leptochilus* sp. nests in old beetle borings in *Ephedra* stems (F. Parker per. comm.) (USU); Inyo Co.: 1♀ 15 km S Deep Springs, 24 May 1994, S. L. Heydon, sweeping *Encelia* (UCD); 1♀ same, except 13 km SE Deep Spring, off *Larrea* (UCD); 1♀ 14 km NW Darwin, 25 May 1994, S. L. Heydon (UCD). San Bernardino Co.: 4♀ 5 mi. N Barstow, 13 May 1979, R. M. Bohart (UCD); Utah: Emery Co.: 1♀ 6 km N Gilson Butte, 3–7 August 1997, M. & J. Wasbauer, pan trap (UCD); 1♀ same, except Wild Horse Creek, N Goblin Valley, 2–7 August 1997 (UCD).

Etymology.—This species is named in honor of the collector, Frank Parker.

Distribution.—This species is widespread in the western and southwestern United States (see Discussion section below).

Hosts.—All specimens were reared from Megachilidae and Vespidae (Eumeninae). Megachilid hosts were: *Ashmeadiella bigeloviae, A. cubiceps, A. gillettei, A. rufipes, Hoplitis bullifacies, H. palmarum, Megachile brevis, Osmia marginata.* Eumenine hosts were *Ancistrocerus* sp. and *Leptochilus* sp.

Although there is no specific insect host data on the specimens collected in Arizona by "Cazier and Mortenson", there are some indications as to what they were actually parasitizing. Label data states that

some were reared from "green plug" and some from galls with "resin pobble" [likely a misspelling of pebble] associated with *Hilaria rigida* (Thurb.) Benth. ex Scribn. (Poaeace). These galls are caused by *Cathilaria rigida* Zerova (Zerova 1999), which is not the actual host. Frank Parker (in litt.) says the following about these rearings: "I have collected nests from these same galls in the same area. They were made by *Ashmeadiella* spp., especially *A. gillettei* Titus (gravel and masticated leaf pulp) and *A. melilotti* Cockerell, the common green plugger! The resin nests are usually made by *A. cactorum* Cockerell, but species of *Proteriades* (now *Hoplitis*) do the same thing, using small pebbles stuck together with resin. All are common in this area. I have reared the same species from other galls and trap stems." It is obvious, then that the empty galls of *Cathilaria* were simply usurped by several genera of bee nest builders.

Biology.—Based on a subsample of 45 rearings by Frank Parker *Microdontomerus parkeri* is a gregarious parasitoid within individual bee cells. The number of individuals ranged from 2 to 33 per cell, with an average of about 8–9. For these rearings the total number of *M. parkeri* specimens was 229 females and 125 males for a sex ratio of 1.8 to 1. Ten of these rearings contained no males.

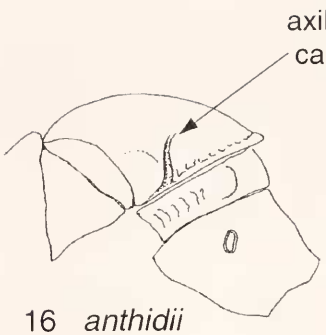
Discussion.—This species superficially resembles *M. anthonomi* but differs in wing setation as explained in couplet 9 of the key. *Microdontomerus parkeri* appears similar to *M. bicoloripes* based on body coloration and in reduced wing setation of the forewing admarginal area (Fig. 6). Coloration sometimes helps distinguish between the two: *M. parkeri* typically has the legs (especially femora, but never the coxae) shaded with black whereas *M. bicoloripes* typically has bright orange legs (sometimes including the coxae, as well). Larger specimens of *M. parkeri* sometimes have the legs entirely orange and smaller specimens of *M. bicoloripes* sometimes have the femora and tibiae infused with black, so the character is not foolproof. *Microdontomerus parkeri* differs in having the speculum and basal cell open behind (Fig. 6) (closed in *M. bicoloripes*, Fig. 9) and in having the lateral ocellus slightly greater than the ocellocular distance (Fig. 39) (less than ocellocular distance in *M. bicoloripes*, Fig. 38).

During my studies I examined a large number of specimens (over 2000, representing over 500 rearings, in the collection of USU) reared from stick trap nests set out by Frank Parker (Research Entomologist, retired; USDA Bee Biology and Systematics Laboratory, Utah State University, Logan). Unfortunately at the time I examined these specimens I believed only one species was present (*M. anthidii*), but as it turns out at least three species were present (*M. parkeri*, *M. enigma*, *M. anthidii*). I have not rechecked all 500 rearings, but based on a reexamined subsample of 355 specimens from 40 rearings, *M. parkeri* was the predominant parasitoid (86%), with *M. anthidii* and *M. enigma* each composing 7% of the total. The state and county records summarized next are almost surely all *M. parkeri* based on its abundance and the known distribution of *M. anthidii* (southern California) and *M. enigma* (Nevada). I did not include them in the above distribution section due to possible confusion: Arizona (Coconino, Yavapai, Maricopa, Yuma, Mohave, Gila, Cochise); California (Fresno, Inyo, Kern, Riverside, San Bernardino); Idaho (Butte, Owyhee); Nevada (Clark, Elko, Humboldt, Lyon, Washoe); New Mexico (Dona, Hidalgo, Luna, Sierra, Socorro, Valencia, Valencia); Utah (Box Elder, Cache, Duchesne, Grand, Juab, Millard, Rich, Washington).

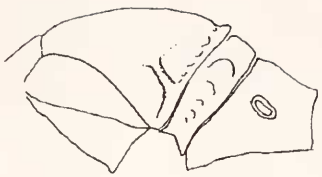
Microdontomerus rictus Grissell, new species

Figs. 19, 26, 45

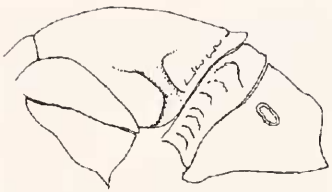
Holotype female.—Body length excluding ovipositor 2.5 mm, ovipositor 1.0 mm. Body black (without metallic sheen) ex-



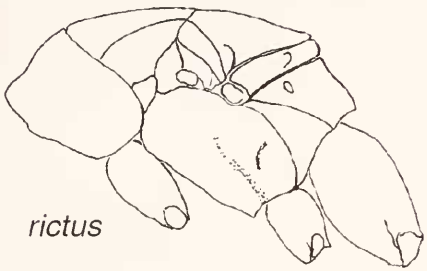
16 *anthidii*



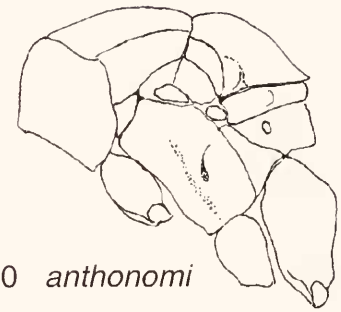
17 *eboreus*



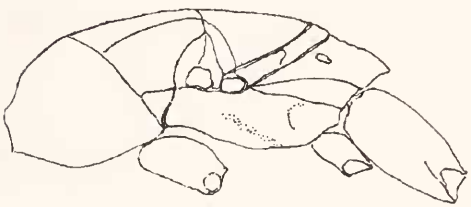
18 *gordhi*



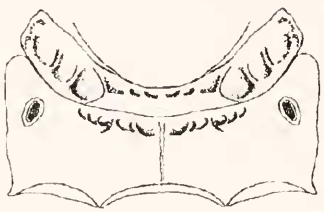
19 *rictus*



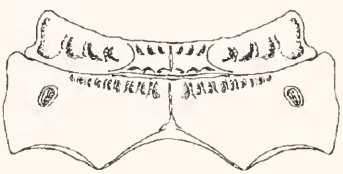
20 *anthonomi*



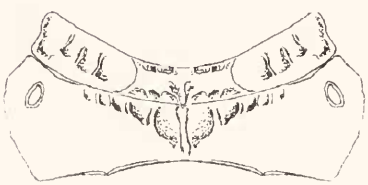
21 *westcotti*



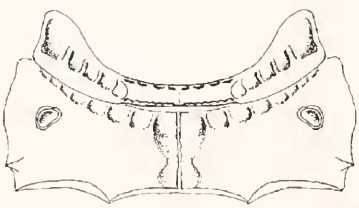
22 *gordhi*



23 parkeri

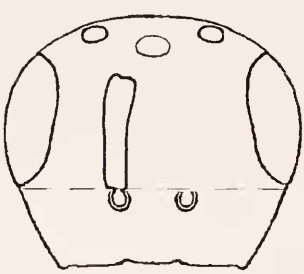


24 *ciscida*

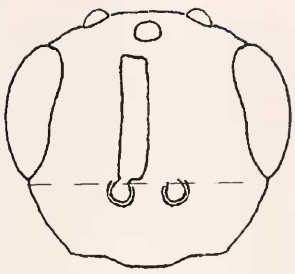


25 *buprestae*

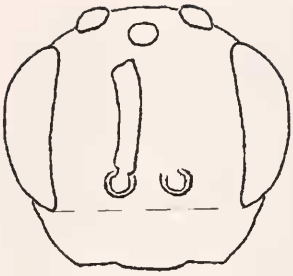
Figs. 16–25. *Microdontomerus* spp., metasoma. 16–18, Scutellum, metanotum, and propodeum, lateral view. 19–21, Entire metasoma, lateral view. 22–25, Metanotum and propodeum, dorsal view.



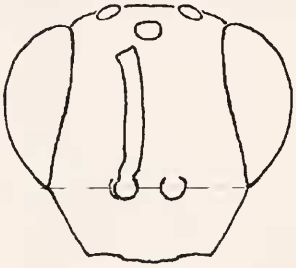
26 *rictus*



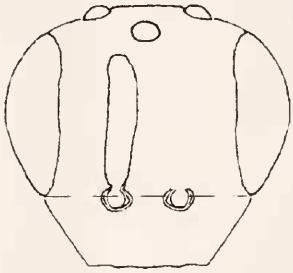
27 *buprestae*



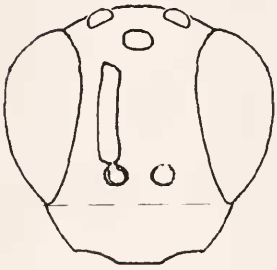
28 *parkeri*



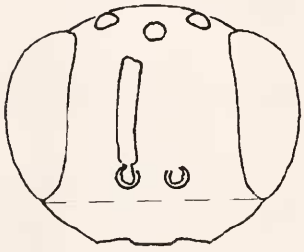
29 *secus*



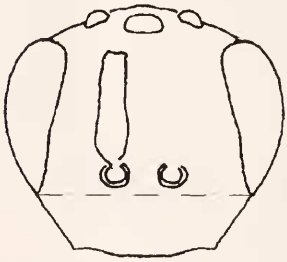
30 *ciscida*



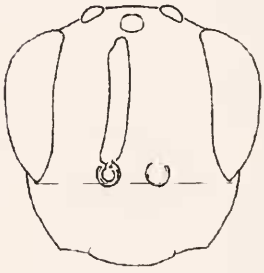
31 *anthidii*



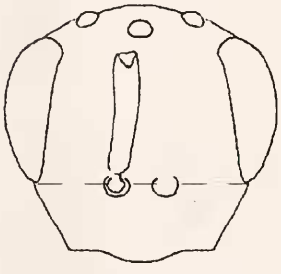
32 *hemileucae*



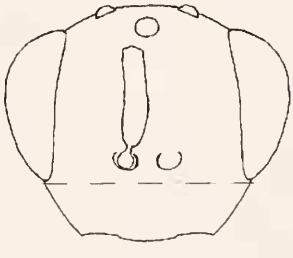
33 *enigma*



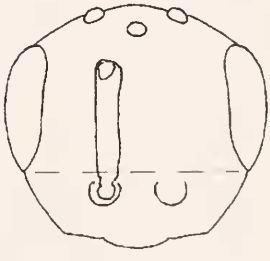
34 *darwini*



35 *mysticus*



36 *bicoloripes*



37 *westcotti*

Figs. 26–37. *Microdontomerus* spp., face showing proportions and position of torulus relative to eye (dashed line).

cept as follows: dark orange are: scape, all tibiae and tarsi; brown are: wing veins, femora. **Head:** Distance between eyes much greater than eye height (about 1.4×); clypeus (Fig. 26) recessed, not projecting beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 14:24:7; dorsum of torulus at lower margin of eyes; toruli about 2 diameters apart; intermalar distance about 2× malar distance; eye height about 1.5× malar distance; antenna (Fig. 45) with pedicel laterally about 2× as long as broad apically, anellus quadrate, as long as F1, funicle segments wider than long, flagellum slightly wider distally than proximally but essentially parallel-sided, scape not reaching median ocellus and separated from it by about an ocellus diameter. **Mesosoma**: Scutellum flat (Fig. 19), nearly in same plane as scutum, metanotum and propodeum not in same plane as apex of scutellum; posterior axillular carina reduced and narrow; dorsellum convex, polished, with obscure median carina and minute pits along dorsal and ventral margins; propodeum with several small pits along anterior margin (perpendicular carinae present), medially flattened, with indistinct carinae extending from dorsal margin and fading medially, nucha a narrow, arched carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle greater than its own longest inner diameter from posterior margin of metanotum, median length of propodeum about 4× longest inner spiracle diameter; forewing ratio PV:MV:SV:SMV as 10:18:5:36, postmarginal vein about 0.5× marginal vein, costal cell below with 1 to 2 complete anterior setal rows, upper surface without setae; basal setal line with several setae; cubital setal line with setae basally (i.e., basal cell closed), with partial bare areas paralleling either side, dorsal and ventral areas ending at about midpoint of marginal vein; basal cell with 1 or 2 setae; admarginal area not defined by posterior line of setae and with 7 or 8 wide spaced setae above, parastigmal and basal areas bare; stigmal area bare. **Metasoma**: MT2 faintly emarginate at apico-median margin; other terga entire; ovipositor sheaths subequal to length of metasoma, 1.5× as long as metatibia.

Male.—Unknown.

Variation.—Females vary in range from about 2.0 to 2.5 mm. The ovipositor is constant at about 1.5× as long as the metatibia. It is difficult to assess wing setation due to the generally poor condition of the wings. Some wings appear to be nearly bare.

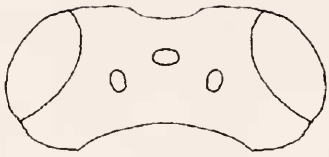
Type material.—Holotype ♀, 18 mi. SW Mt. [Mountain] Home, Elmore Co., Idaho, January 1958, W. F. Barr, "reared from larva from *Cylindrocopterus* boring in bud sage" (USNM); 3♀ paratypes, same data (USNM); 1♀ paratype, Fernley, Lyon Co., Nevada, 11 June 1974, R. M. Bohart (UCD).

Etymology.—From "*rictus*", Latin for "open mouth", in reference to the large malar opening.

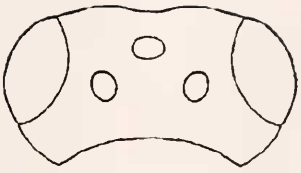
Distribution.—Known only from Elmore County, Idaho.

Host.—Reared from *Cylindrocopterus* sp. (Curculionidae) borings in bud sage (= *Artemisia spinescens* D. C. Eaton) (Asteraceae).

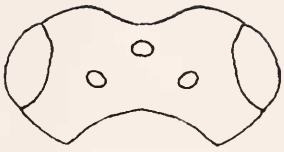
Discussion.—*Microdontomerus rictus* belongs to the group of species in which the scutellum is dorsally flattened and smooth (or at least less sculptured in contrast to the anterior of the scutum), the venter of the torulus is low on the face relative to the lower margin of the eye, and the ocellocular distance is greater than the longest lateral ocellus diameter. The species is unique in having a relatively wide head (Fig. 26) with the toruli about 2 diameters apart (1 diameter in all other species), the eyes about 1.5× the malar distance (1.7 or greater in other species), and the distance between the eyes about 1.5× the eye height (1.2 or less in other species).



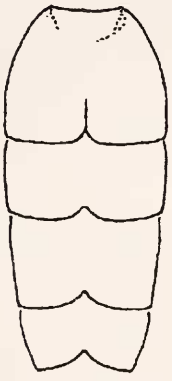
38 *bicoloripes*

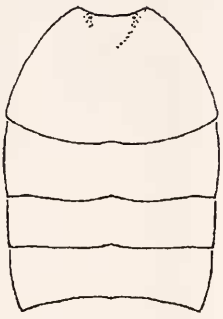


39 *parkeri*



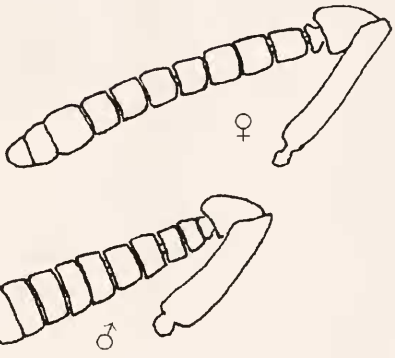
40 *westcotti*



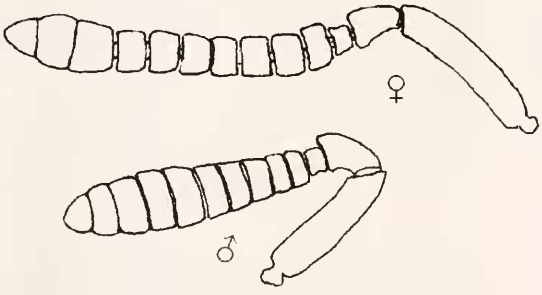


42 *mysticus*

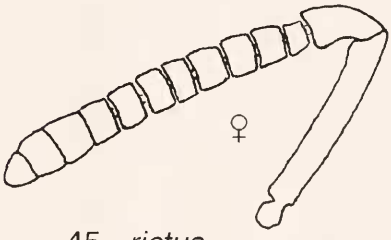
41 *buprestae*



43 *enigma*



44 *westcotti*



45 *rictus*

Figs. 38–45. *Microdontomerus* spp., 38–40, Head, dorsal view showing relative position of ocelli. 41–42, Metasomal terga (MT). 43–45, Antennae, lateral view.

Microdontomerus secus Grissell, new species

Figs. 29, 53

Holotype female.—Body length excluding ovipositor 2.0 mm, ovipositor 0.5 mm. Body black (without metallic sheen) except yellow-orange are: scape, tibiae, and tarsi; wings weakly shaded brown below marginal vein, wing veins brown. **Head**: Distance between eyes slightly less than eye height; clypeus (Fig. 29) level with lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 5:16:6; venter of torulus on line with venter of eyes; toruli about 1 diameter apart; intermalar distance about 1.5× malar distance; eye height about 2.0× malar distance; antenna (Fig. 53) with

pedicel laterally about 1.5× as long as broad apically, anellus not elongate, shorter than F1, funicle segments wider than long, flagellum parallel-sided, club (Fig. 53, inset) appearing 4-segmented and with flat micropilose ventral area covering surface except base and lateral margins of first clavomere; scape nearly reaching median ocellus, separated from it by less than half an ocellus diameter. **Mesosoma:** Scutellum convex, not in same plane as scutum; metanotum and propodeum angled downward from plane of scutellum; posterior axillular carina short, straight, and slightly widened dorsally; dorsellum irregularly carinate with deep pits; propodeum covered with raised reticulation, with pits along anterior margin (perpendicular carinae present) becoming smaller towards outer margin, with strong median carinae extending from dorsal margin to nucha, nucha a narrow arched carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle subequal to own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing ratio PV:MV:SV:SMV as 15:22:8:65, postmarginal vein about 0.6× marginal vein, costal cell below with 1 to 2 complete anterior setal rows and nearly covered with setae except median crescent area, upper surface with anterior setal row in distal half; basal setal line complete; cubital setal line complete (i.e., basal cell closed), with partial bare areas paralleling both sides and ending at about midpoint of marginal vein; basal cell with complete setal row; admarginal area not defined by posterior line of setae and with dense setae above, parastigmal and basal areas bare; stigmal area setose. **Metasoma:** Terga entire, without median emarginations; ovipositor sheaths shorter than metasoma, 0.7× as long as metatibia.

Male.—Unknown.

Variation.—The paratype specimen exhibits a more notable infumation of the wings, and the micropilose ventral area of the clava is slightly concave rather than flat.

Type material.—Holotype ♀, 45 km NW Santa Barbara, Santa Barbara Co., California, Sedgewick Reserve, 25 June 1997, E & M. Schlinger, Malaise trap (USNM); 1♀ paratype, Kern River Canyon, 4–7 mi. E Johnsondale, Tulare Co., California, 22 May 1991, N. J. Smith (UCD).

Etymology.—From "*secus*", Latin for "different", in reference to the micropilar areas on the ventral aspect of the club, which so far is unique to this species.

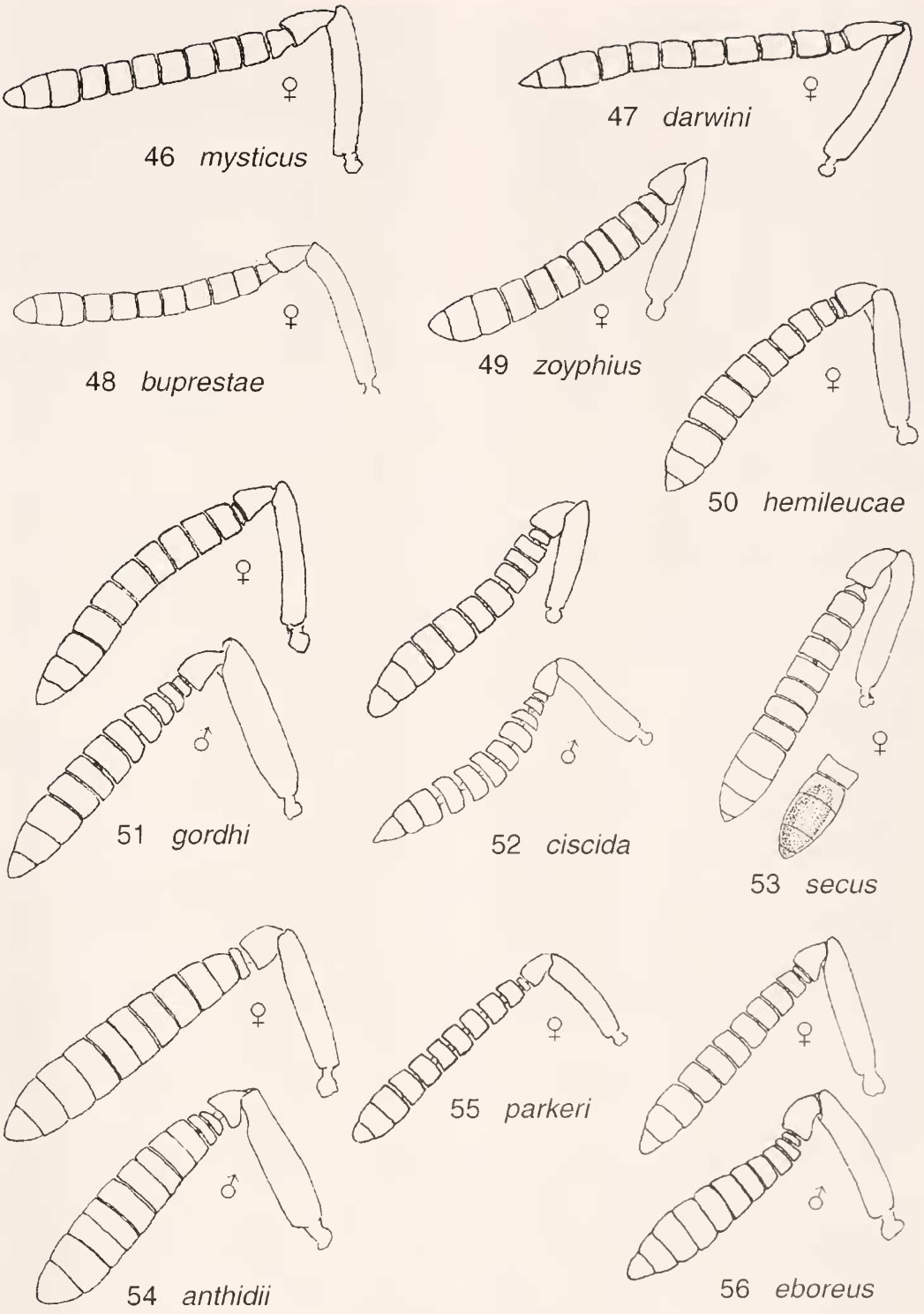
Host.—Unknown.

Discussion.—This is the only species known so far with the ventral area of the club (except basal half of C1) covered with micropilosity (Fig. 53, inset). The area is flat in the holotype and concave in the paratype (likely an artifact of collapse). The species also appears to have a distinctly 4-segmented club as a result of an annulation just before its apex. This annulation is either absent or not easily seen in other species. The extremely short ovipositor, which is 0.7× the length of the metatibia, and the slightly shaded wings also help distinguish this species.

Microdontomerus westcotti Grissell, new species

Figs. 21, 37, 40, 44

Holotype female.—Body length excluding ovipositor 2.0 mm, ovipositor 0.8 mm. Body brown (without metallic sheen) except as follows: dark brownish yellow are: scape, tibiae (except apex white); tarsi white. **Head**: Distance between eyes slightly greater than eye height (1.2×); clypeus (Fig. 37) projecting beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 12:20:5 (Fig. 40); dorsum of torulus at venter of eyes; toruli about 1 diameter apart; intermalar distance about 1.7× malar distance; eye height about 1.7× malar distance; antenna (Fig. 44♀) with pedicel laterally about 2× as long as



Figs. 46–56. *Microdontomerus* spp., antennae, lateral view. 53, Inset, venter of club.

broad apically, anellus quadrate, shorter than F1, funicle segments wider than long, flagellum slightly wider distally than proximally but essentially parallel-sided, scape not reaching median ocellus, separated from it by about an ocellus diameter. **Mesosoma:** Scutellum flat (Fig. 21), nearly in same plane as scutum, metanotum and propodeum flat and in same plane as apex of scutellum; posterior axillular carina reduced and narrow; dorsellum flat, with slight median groove and no pits; propodeum subhorizontal (Fig. 21), with several small pits along anterior margin (perpendicular carinae present), medially flattened, with distinct carinae extending from dorsal margin to nucha, nucha a narrow, arched carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle greater than own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3× longest inner spiracle diameter; forewing ratio PV:MV:SV:SMV as 2:4:1:13, postmarginal vein about 0.5× marginal vein, costal cell below with 1 to 2 complete anterior setal rows, upper surface without setae; basal setal line complete; cubital setal line with setae basally (i.e., basal cell closed), with partial bare areas paralleling either side, dorsal and ventral areas ending at about midpoint of marginal vein; basal cell with complete setal row; admarginal area not defined by posterior line of setae and with dense setae above, parastigmal and basal areas bare; stigmal area bare. Metasoma: MT2-3 slightly emarginate at apico-median margin; other terga entire; ovipositor sheaths shorter than meso- plus metasoma, 1.4× as long as metatibia.

Male.—Body length 2.0 mm. Color, sculpture, and other characters about as for female except: eye height about 3× malar distance; scape ventrally flat and polished; antenna spindle-shaped (Fig. 43♂), basal flagellomeres reduced, much wider than long (F1-2 "anellus-like", but with multiporous plate sensilla).

Variation.—Females vary from about 1.6 to 2.6 mm. The specimens reared from *Baris* are black (instead of brown) with the scape mostly black. The single female from Riverside has a very slight purplish metallic sheen on the head, as do some of the paratypes, but this is difficult to see.

Type material.—Holotype ♀, 4 mi. N Red Bluff, Tehama Co., California, 4 April 1975, R. L. Westcott, ex *Namularia californica* pupal cell in crown of *Eriogonum nudum* (USNM); 10♀, 1♂ paratypes all same data (USNM); 5♀, California, Yolo Co., 4 mi. NE Woodland (sewer pond), em. February 1971, J. E. Lauck, ex *Baris digitata* [lapsus for *dilatata*] in root of *Xanthium* sp. (USNM, UCD).

Additional material examined.—1♀, Riverside, Riverside Co., California, 17 July 1978, J. C. Hall (UCR).

Etymology.—This species is named for Rick Westcott, the collector, who has discovered several wonderful new species of *Microdontomerus* while studying the lesser beetles he somehow finds interesting.

Distribution.—*Microdontomerus westcotti* is known from Tehama and Yolo counties in northern California and Riverside County in southern California.

Host.—This species was reared from *Namularia californica* (Burprestidae) in the crown of *Eriogonum nudum* (Douglas ex Bentham) (Polygonaceae) and from *Baris dilatata* (Curculionidae) infesting roots of *Xanthium* sp. (Asteraceae).

Discussion.—*Microdontomerus westcotti* belongs to a group of species in which the scutellum is dorsally flattened and smooth (or at least less sculptured in contrast to the anterior of the scutum), the venter of the torulus is low on the face relative to the lower margin of the eye, and the ocellocular distance is greater than the longest lateral ocellus diameter. This is one of the smallest, least robust species in the genus, having scarcely any distinct sculpturing or propodeal carinae. It keys out with *M. zoyphius*, from which it can be separated by characters given in the key.

The specimen cited above from Riverside appears morphologically identical to *M. westcotti*, but its distribution is far removed to the south of the type localities. It also has some metallic reflection, suggesting that it might not be *M. westcotti*, which is why I did not include it in the type series.

Microdontomerus zoyphius Grissell, new species

Figs. 4, 49

Holotype female.—Body length excluding ovipositor 2.8 mm, ovipositor 0.7 mm. Body black (without metallic sheen) except orange are: scape, tibiae, and tarsi; wing veins brown. **Head**: Distance between eyes subequal to eye height; clypeus barely projecting beyond lateral corners of oral fossa; ratio of ocellocular distance: postocellar distance: lateral ocellus diameter 6:12:5; dorsum of torulus about half own diameter lower than eyes; toruli slightly greater than own diameter apart; intermalar distance about 2× malar distance; eye height about 2× malar distance; antenna (Fig. 49) with pedicel laterally about 2× as long as broad apically, anellus transverse, much shorter than F1, funicle segments wider than long, flagellum parallel-sided, scape not reaching median ocellus, separated from it by about an ocellus diameter. **Mesosoma**: Scutellum flat, nearly in same plane as scutum, metanotum and propodeum flat and in same plane, but not in same plane as apex of scutellum; posterior axillular carina reduced and narrow; dorsellum convex, smooth, without median carina, dorsal margin with small pits; propodeum subhorizontal, with several small pits along anterior margin (perpendicular carinae present), with distinct median carina subtended by barely perceptible depressions on either side, carina extends from dorsal margin to nucha, which is narrow, arched carina, posterolateral corner of propodeum rounded, without distinct projecting denticle; spiracle slightly less than own longest inner diameter from posterior margin of metanotum, median length of propodeum about 3.5× longest inner spiracle diameter; forewing ratio PV:MV:SV:SMV as 3:6:2:14, postmarginal vein about 0.5× marginal vein, costal cell below with 1 to 2 complete anterior setal rows and nearly covered with setae, upper surface without setae; basal setal line complete; cubital setal line with setae basally (i.e., basal cell closed), with partial bare areas paralleling ventral side, ending at about midpoint of marginal vein; basal cell with complete setal row; admarginal area not defined by posterior line of setae and with dense setae above, parastigmal and basal areas bare; stigmal area asetose. **Metasoma**: MT2 slightly emarginate at apico-median margin, other terga without emarginations; ovipositor sheaths shorter than metasoma, 1.0× as long as metatibia.

Male.—Unknown.

Variation.—The two females show little variation.

Type material.—Holotype ♀, Texas, Brewster Co., Big Bend National Park, Buttril Spring, 4–5 October 1991, R. Wharton (TAMU); 1♀ paratype same data (USNM).

Etymology.—From "*zoyphion*", Greek for "little animal".

Distribution.—Known only from Texas.

Host.—Given the similar appearance and flattened habitus of this species relative to *M. westcotti* and *M. buprestae*, which attack buprestids, I suspect that *M. zoyphius* most likely attacks beetles in this family as well.

Discussion.—*Microdontomerus zoyphius* belongs to a group of species in which the scutellum is dorsally flattened and smooth (or at least less sculptured in contrast to the anterior of the scutum), the venter of the torulus is low on the face relative to the lower margin of the eye, and the ocellocular distance is greater than the longest lateral ocellus diameter. Phenotypically this species is a bit more like *M. ciscida* and *M. mysticus* relative to the propodeum

than to *M. westcotti* with which it keys out. The former two species have very distinct, strongly indicated depressions, pits, and carinae surrounding the median propodeal carina, whereas *M. zoyphius* has barely distinguishable shallow, reticulate areas on either side of the median carina. *Microdontomerus westcotti* has an essentially smooth propodeum and differs from *M. zoyphius* as indicated in the key.

HOST-PARASITOID LIST
(alphabetic)

COLEOPTERA

Anthribidae

Brachytarsus sp. see *Trigonorhinus* sp.

Trigonorhinus sp.: *Microdontomerus anthonomi*

Burprestidae

Chrysobothris sp.: *Microdontomerus buprestae*

?*Chrysobothris* sp.: *Microdontomerus mysticus*

Nanularia californica (Horn): *Microdontomerus westcotti*

Cerambycidae

Crossidius hirtipes LeConte: *Microdontomerus mysticus*

Chrysomelidae (Bruchinae):

Acanthoscelides aureolus (Horn): *Microdontomerus anthonomi*

Acanthoscelides compressicornis (Schaeffer): *Microdontomerus anthonomi*

Acanthoscelides derifieldi (Johnson): *Microdontomerus anthonomi*

Acanthoscelides desmanthi (Johnson): *Microdontomerus anthonomi*

Acanthoscelides horni (Pic): *Microdontomerus anthonomi*

Acanthoscelides mixtus (Horn): *Microdontomerus anthonomi*

Acanthoscelides pullus (Fall): *Microdontomerus anthonomi*

Bruchus brachialis Fahraeus: *Microdontomerus anthonomi*

Bruchus pisorum (L.): *Microdontomerus anthonomi*

Sennius morosus (Sharp): *Microdontomerus anthonomi*

Stator limbatus (Horn): *Microdontomerus anthonomi*

Stator pruininus (Horn): *Microdontomerus anthonomi*

Curculionidae

Anthonomus grandis Boheman: *Microdontomerus anthonomi*

Bangasternus orientalis (Capiomont): *Microdontomerus anthonomi*

Baris dilatata Casey: *Microdontomerus westcotti*

Cylindrocopterus sp.: *Microdontomerus rictus*

Lixus parcus LeConte: *Microdontomerus ciscida*

Microlarinus lareynii (Jaquelin du Val): *Microdontomerus anthonomi*

Rhinocyllus conicus Froelich: *Microdontomerus anthonomi*

DIPTERA

Tephritidae

Urophora affinis Frauenfield: *Microdontomerus anthonomi*

Tachinidae

Deopalpus contiguus Reinhard [via *Eucaterva variaria*]: *Microdontomerus eboreus*

Exorista mella (Walker): *Microdontomerus fumipennis*

?tachinid [via *Hemileuca magnifica*]: *Microdontomerus fumipennis*

HETEROPTERA

Pentatomidae

eggs: *Microdontomerus hemileucae*

HYMENOPTERA

Braconidae

Aleiodes sp. [via *Sagenosoma elsa* larva]: *Microdontomerus braconivorus*

?*Aleiodes malacosomatos* (Mason) [via *Malacosoma disstria* larva]: *Microdontomerus fumipennis*

Bracon mellitor Say: *Microdontomerus anthonomi*

Cynipidae

Antistrophus chrysothamni Beutenmüller: *Microdontomerus bicoloripes*

Antistrophus lygodesmiaepisum Walsh: *Microdontomerus bicoloripes*

Eupelmidae

?*Anastatus semiflavidus* [via *Hemileuca olivae* egg] Gahan: *Microdontomerus hemileucae*

Ichneumonidae

ichneumonid [via "tussock moth"]: *Microdontomerus fumipennis*

ichneumonid pupa [via *Agapema galbina anona*]: *Microdontomerus fumipennis*

Megachilidae

Anthidium consimile see *Dianthidium pudicum consimile*

Ashmeadiella bigeloviae (Cockerell): *Microdontomerus parkeri*

Ashmeadiella cubiceps (Cresson): *Microdontomerus parkeri*

Ashmeadiella gillettei Titus: *Microdontomerus parkeri*

Ashmeadiella rufipes Titus: *Microdontomerus parkeri*

Dianthidium pudicum consimile (Ashmead): *Microdontomerus anthidii*

Dianthidium sp.: *Microdontomerus anthidii*

Hoplitis bullifacies Michener: *Microdontomerus enigma, Microdontomerus parkeri*

Hoplitis palmarum (Cockerell): *Microdontomerus parkeri*

Megachile brevis Say: *Microdontomerus parkeri*

Megachile montivaga Cresson: *Microdontomerus apianus*

Osmia marginata Michener: *Microdontomerus parkeri*

Vespidae

Ancistrocerus sp.: *Microdontomerus parkeri*

Leptochilus sp.: *Microdontomerus anthidii, Microdontomerus parkeri*

LEPIDOPTERA

Coleophoridae

Coleophora malivorella Riley: *Microdontomerus anthonomi*

Coleophora parthenica Meyrick: *Microdontomerus anthonomi*

Geometridae

Eucaterva variaria Grote [ex *Deopalpus contiguus* in host]: *Microdontomerus eboreus; Microdontomerus gordhi*

Lasiocampidae

Malacosoma californicum fragile (Stretch): *Microdontomerus fumipennis*

Malacosoma disstria (Hübner) [? ex *Aleiodes malacosomatos* in larval host mummy]: *Microdontomerus fumipennis*

Malacosoma fragile see *Malacosoma californicum fragile*

Malacosoma incurvum (Hy. Edwards): *Microdontomerus fumipennis*

Lymantriidae

Orgyia pseudotsugata (McDunnough): *Microdontomerus fumipennis*

Orgyia vetusta (Boisduval): *Microdontomerus fumipennis*

Saturniidae

Agapema galbina anona (Ottolengui) [ex ichneumonid pupa]: *Microdontomerus fumipennis*

Hemileuca magnifica (Rotger) (or? hyperparasite in tachinid): *Microdontomerus fumipennis*

Hemileuca olivae Cockerell: *Microdontomerus fumipennis; Microdontomerus hemileucae*

Sphingidae

Sagenosoma elsa (Strecker) [ex *Aleiodes* in larva]: *Microdontomerus braconivorus*

Tortricidae

Ancylis comptana (Froelich): *Microdontomerus anthonomi*

Archips argyrospila (Walker): *Microdontomerus fumipennis*

Choristoneura rosaceana (Harris): *Microdontomerus fumipennis*

Rhyacionia zonana (Kearfott): *Microdontomerus fumipennis*

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